OVERSIGHT HEARING ON TRITIUM PRODUCTION

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Oversight Hearing on Tritium Produc...

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND POWER

OF THE

COMMITTEE ON COMMERCE
HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTH CONGRESS

FIRST SESSION

NOVEMBER 15, 1995

Serial No. 104–47

Printed for the use of the Committee on Commerce

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OVERSIGHT HEARING ON TRITIUM PRODUCTION

WEDNESDAY, NOVEMBER 15, 1995

House of Representatives,
Committee on Commerce,
Subcommittee on Energy and Power,
Washington, DC.

The subcommittee met, pursuant to notice, at 10:05 a.m., in room 2322, Rayburn House Office Building, Hon. Michael D. Crapo presiding.

Members present: Representatives Schaefer, Crapo, Deal, Whitfield, Norwood, Pallone, and Markey.

Staff present: Troy Timmons, majority professional staff member; and Sue Sheridan, minority counsel.

Mr. Crapo. The subcommittee will come to order. We would like to welcome everybody here today to the Subcommittee on Energy and Power for this oversight hearing on tritium production and the report of the Speaker's Task Force on getting on with tritium production.

I will announce at the outset that I am sitting in for the Chairman, Mr. Schaefer, briefly this morning. He is on the floor and should be here in just a few moments, but he wanted us to get started on time and to proceed, and without objection, the Chairman's opening statement will be placed in the record.

[The prepared statement of Hon. Dan Schaefer follows:]

Prepared Statement of Hon. Dan Schaefer, Chairman, Subcommittee on Energy and Power

Today's hearing focuses on the Department of Energy's efforts to secure a future source of tritium, a crucial element in the maintenance of our nuclear weapons stockpile. Tritium gas is a component of every weapon in the U.S. nuclear arsenal, yet has not been produced here since 1988. With a relatively short half-life of just over 12 years, the available supply of tritium decays quite rapidly, and the U.S. loses over five percent of its supply each year.

Due to aggressive recycling efforts, however, DOE does not anticipate a shortage of tritium until 2010. In anticipation of that date, DOE has been examining a number of options for tritium production and seems to have settled on a dual track strategy which would examine the purchase of tritium services from an existing commercial nuclear reactor and the construction of an accelerator for tritium production. A number of other options currently exist, many of which propose that DOE construct a new nuclear reactor dedicated primarily to tritium production.

It is not the task of this Committee to determine which technology option DOE should pursue. The oversight of that decision lies with the National Security Committee. However, the choices DOE makes will likely have a noticeable impact on the commercial nuclear power industry. If the choice is made to utilize existing reactors for tritium production, there is some modification of affected plants which will be necessary. If DOE decides to pursue construction of a new reactor, the power such a plant would generate to the electric grid needs to be taken into consideration. And regardless of the design option chosen, the health and safety of workers and the surrounding communities needs to be taken into consideration, as well as the effects on the production of additional high-level radioactive waste.

Let me also mention the efforts of the Speaker's Task Force on Nuclear Waste and Tritium Production in this regard. These members have spent a great deal of time and effort examining the tritium issue, and DOE's actions to secure a source of new tritiun. It will be helpful to the Committee to learn of the Task Force's efforts and recommendations for action by DOE.

I think today's hearing offers us a great opportunity to learn more about the impacts of DOE's tritium program and look forward to the testimony of our witnesses. I especially want to welcome Deputy Secretary Charlie Curtis to the Subcommittee. If I recall correctly, this is his first visit to the Commerce Committee this year, and it is a pleasure to have him before us today.

Mr. CRAPO. I would like to welcome our first panel, the Honorable Lindsey Graham and the Honorable John Ensign. We appreciate you—excuse me, I am getting ahead of myself.

Before we go to other opening statements, let me say not just to those giving open statements, to other panelists, our clock system doesn't work here. That is why you don't see any green and red lights in front of you today. But we do have a stopwatch, so we are going to be using the stopwatch system, and as long as I am here, we will give you some little taps like you hear on C-SPAN and that will be the indication that your time has expired, you should start wrapping up.

Mr. ENSIGN. Mr. Chairman, is it nuclear-powered stopwatch?

Mr. CRAPO. All it says is Sportline. I don't know about that. We will have to check it out.

Without anything further, we will go to Mr. Pallone, the ranking member. Do you have an opening statement?

Mr. PALLONE. Thank you, Mr. Chairman.

I saw Mr. Schaefer on the floor, and he told me that you were going to be presiding here initially, and I ran over here to make sure that—I thought I could stay there with him and I would be okay. I realized that since you were here, I would have to run over.

Mr. CRAPO. We have Mr. Markey here. He could have let you know that. He could have protected your interest.

Mr. PALLONE. I just wanted to say, I am glad the subcommittee is continuing its long tradition of oversight of the DOE nuclear complex. The Department, I believe, has come a long way in recent years toward improving the safety and efficiency of these facilities. However, since the DOE still is not subject to outside regulation, it is important for Congress to continue keeping an eye on its progress.

It is clear that at some point in time the United States has to develop a new source of tritium production. It will be needed to replace the old DOE defense production reactors which were shut down at the end of the cold war, in part due to safety concerns. However, we should make sure that the lessons learned from that experience, especially concerning the danger of valuing production over safety, should not be forgotten.

DOE has done a good job in its programmatic environmental impact statement of laying out the major considerations for securing a new tritium production source. I have to say that while I am not an expert, the option of converting an existing commercial nuclear reactor to tritium production seems to have a lot of appeal in terms of cost. Picking the least expensive alternative is critical in terms of other environmental considerations, since every dollar directed to nuclear weapons production is a dollar that cannot be used to clean up the weapons plants.

I understand that the other option that the DOE is studying, building a linear accelerator, has some environmental advantages over the existing reactor option. Chief among these is that it does not produce high-level nuclear waste.

I am interested in asking Mr. Curtis how DOE plans to assess the relative environmental impacts of its two leading options. We have to keep in mind that in this era of limited Federal funding, competition for this project has been and will continue to be intense.

It must have been difficult for DOE to choose among competing economies' proposals and to keep its eye on the immediate issue at hand, tritium production. If the new best tritium source turns out to have commercial or scientific benefits for someone, that is great, but those shouldn't be the primary considerations and we can't afford to let this turn into a public works project.

DOE seems to have developed a sensible plan for selecting the best type of facility, and it should be commended for doing this on time. I have a feeling that this is the case where NEPA really benefited the process by keeping politics to a minimum and ensuring that no stone is left unturned before the final decision is made.

I understand that there was a Speaker's Task Force and these gentlemen are a part of that. It will be interesting to hear what you have to say. I notice, of course, the fact that the Speaker has paid and all of you have paid quite a bit of attention to this, and you are to be congratulated for that. Thank you.

Mr. CRAPO. Thank you, Mr. Pallone.

The gentleman from Massachusetts, Mr. Markey.

Mr. MARKEY. Thank you, Mr. Chairman, very much.

Mr. Chairman, I must confess to some mixed feelings at this moment. I generally favor the idea of holding hearings to examine the Department of Energy's plans to produce tritium, an important part of our nuclear weapons deterrent. I think it is time for us to have a national debate in this country about the future of nuclear weapons in a post-cold war world and how to bring about ratification of the START II treaty and further arms reductions, leading ultimately to fulfillment of President Reagan's goal, which I share, of eliminating these deadly weapons from the face of the Earth.

In that broader context of further arms reductions, we will have to make determinations about how much tritium we will need and when. Before we get on with handing out checks to a bunch of contractors to produce tritium, we should think this through. An amendment I offered along with Representative Vucanovich and Representative Ensign to the tritium section of this year's Defense Department authorization bill called for congressional hearings on the best way to assure our tritium supply before a final decision is made.

In a strong bipartisan effort, the House passed our amendment. However, I must note for the record that it seems rather bizarre to be holding a hearing on a pork barrel project which has already been rejected by both the House and the Senate on a day when the entire Federal Government is shut down due to the current budget impasse. I am not at all certain that oversight hearings to examine the findings of the Speaker's Task Force on tritium production really constitutes an essential government function since the House already voted to kill this project.

I am also kind of mystified, because when I look at that chart of how our laws are made that we try to teach to sophomores in high school, I have never seen a Speaker's Task Force on getting on with tritium production as one of the subcategories, especially after the House has already acted on the item. But, nonetheless, today's hearings look like a desperate last-ditch effort to make a second play for the triple-play reactor. Nevertheless, I am happy to join in burying this budget-busting boondoggle once again.

Now, let me begin by saying that I am very pleased to report that, like generalissimo Francisco Franco, the triple-play reactor remains dead. It was buried this summer by the united opposition of the National Security Council, the National Taxpayers Union, the National Academy of Sciences, the Department of Defense, the Department of Energy and 214 Members of the House of Representatives, including 49 Republicans as disparate as Ed Markey and John Ensign in terms of the political spectrum.

While no one denies the ultimate need for a dependable tritium source so long as we retain nuclear weapons, there have been disagreements over exactly how to develop a source capable of meeting our national security requirements and exactly when we will need to produce additional tritium, given the current pace of arms reductions.

Eight members of the Speaker's Task Force believe we should plow millions of dollars into a crash program to build a brand-new nuclear reactor that will do three things: burn excess weapons plutonium, generate electricity and produce plutonium—sort of like a radioactive kitchen magician. It slices, it dices, it burns plutonium, it makes tritium, it generates electricity; and you ask, how much do I have to pay for such a handy gadget? Well, it can be all yours for only $6 billion. At a time of tight budgets, this is one piece of radioactive pork that we can ill afford.

During floor consideration of this year's Defense Department authorization bill, the House deleted a special earmark in the authorization bill that granted a foreign-led consortium an exclusive contract to build the triple-play reactor, and now, like a bad horror movie, it is back again. After an exhaustive review of the options, the Department of Energy is nearing a final decision on the best technology for meeting our tritium needs.

The key issue for the Department and the Congress to consider in making this decision is precisely how much tritium will we need, given the pace of arms reductions, and what is the best and least expensive way of meeting these need?

I look forward to the testimony of the witnesses this morning and I thank you, Mr. Chairman, for conducting the hearing.

Mr. CRAPO. Thank you, Mr. Markey. I just have to say it is always nice to hear your great alliteration, and I look forward to many more discussions with you. I would note that I think that we are probably going to have an opportunity to revisit many of the unwise decisions made by past Congresses, and maybe——

Mr. MARKEY. It is this Congress that made the unwise decision to kill it.

Mr. CRAPO. That can be revisited as well. There were some unwise decisions made in the last Congresses that you and I have talked about before in this same Congress made, and I suspect that we will have opportunities to discuss our different points of view on these issues many times.

Let's see. I am advised Mr. Whitfield is next in line for your time. As I have said to the rest of the group before you—several of you came in, we do not have a light, but we do have a timer here, and we are going to try to give you a little bit of signal from up here if you start running over.

Thank you, Mr. Whitfield.

Mr. WHITFIELD. Mr. Chairman, I filed an opening statement for the record, and I will dispense with any remarks at this time.

Mr. CRAPO. Thank you.

[The prepared statement of Hon. Ed Whitfield follows:]

PREPARED STATEMENT OF HON. ED WHITFIELD, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF KENTUCKY

I want to thank Chairman Schaefer for agreeing to hold this hearing on the future of tritium production in this country.

While there seems to be general consensus on the need to renew the Defense Department's supply of tritium, there is also consensus on which option we should use to insure that renewal. Obviously, cost is a major consideration, but other factors must be looked at, including safety, environmental concerns, good sound science, and national security requirements.

Should the federal government build a new reactor?

Should we build a particle accelerator system?

Or should we modify an existing commercial reactor?

I know there are some who have already decided which of these options is the best way to go, but I have not. I look forward to learning more about the issue from the distinguished witnesses we have here today.

Mr. Chairman, let me thank you again for holding this hearing.

Mr. CRAPO. Mr. Norwood.

Mr. NORWOOD. Thank you, Mr. Chairman. I am sorry I was a little late, and so glad I got here for the Markey Comedy Hour. It always starts my day off right to get a few chuckles.

With your permission, I will in fact read my statement this morning. And I do appreciate very much Mr. Schaefer calling this hearing.

Tritium production is a front-burner issue in our hometown. It is right across the river from my home in Augusta, which is one of the most nuclear-friendly areas in the country and the only place where weapons-grade tritium has ever been produced, the Savannah River Site. At Savannah River, there resides the technological base, the personnel and the infrastructure that I, as a taxpayer, have been paying on for years to produce tritium to maintain the United States' nuclear deterrent.

The 21st century is not that far off, and we are running out of time. The Savannah River Site last produced tritium in 1988. If START II is not ratified, we will need to have a new source of tritium up and running by the year 2005. Needless to say, it is time to focus our efforts.

Today, we will hear about the various means to produce tritium to meet the deadlines, and my first choice, of course, is a triple-play reactor—if I wondered about it before, after this morning I know that is my first choice—which can in fact produce tritium, dispose of plutonium and generate electricity. In the long run, I think this is the most cost-effective and efficient way to basically get the job done.

We can privatize the construction of the reactor, and since it will produce its own electricity, it will not require an outside power source. In fact, we should look at even buying a reactor, which is very available to the Savannah River Site.

Having said all that, I am still open to other technologies to produce tritium, and I will therefore listen carefully. I do, however, have my doubts about the life-cycle cost of an accelerator, and its ability to produce what we need is still unproven. Perhaps some of our witnesses will elaborate on that.

I am intrigued by the idea of producing tritium in a commercial reactor. This proposal which the Department of Energy has recently floated—very recently, I might add—could serve as an interim source of tritium until a permanent source can be built. We may have to look at this more closely as the deadlines for production creep up on us.

Regardless of the technology, I am sure of one thing: The Savannah River Site is the only place to produce tritium because of your past investments, because of the knowledge. The institutional knowledge and the institutional memory is there. The community at Savannah River appreciates each mission it performs, and we are going to fight to see it maintains the task of producing tritium for our defense needs. These cold war warriors deserve that.

Mr. Chairman, I thank you again, and I have enjoyed serving with you on the Speaker's Task Force on Environmental Cleanup. I would like to acknowledge to the world the fine work of Congressman Lindsey Graham, who is here with us today to testify as Chairman of the Speaker's Task Force on Tritium Production. I look forward to today's deliberations, and I thank each of our witnesses in advance for their participation.

Thank you. I yield back.

Mr. CRAPO. Thank you, Mr. Norwood. And the Chair would ask unanimous consent that any other members be given the opportunity to put their opening statements in the record. Without objection, it is so ordered.

[The prepared statements of Hon. Thomas J. Bliley, Jr. and Hon. Michael Bilirakis follow:]

PREPARED STATEMENT OF HON. THOMAS J. BLILEY, JR., CHAIRMAN, COMMITTEE ON COMMERCE

Mr. Chairman, I appreciate your holding this hearing. The issue of tritium production is a very important one, both from a national defense perspective and from the possible effects DOE's decisionmaking may have on nuclear utilities and electricity generation. While our friends at the National Security Committee have primary jurisdiction over this matter, we at the Commerce Committee do have concerns about the commercial impacts of DOE's actions in this regard, and the matter is certainly of sufficient importance to merit our attention today.

As you know, tritium is a critical component of the weapons in our nation's nuclear arsenal. Though our reliance on the nuclear deterrent has decreased with the end of the Cold War, these weapons will continue to be an integral part of the nation's strategic defense. And while we can stretch our current supply of tritium with recycling, it doesn't take much of a math genius to figure out that there are definite limits on our ability to maintain an adequate supply of the gas by recycling.

DOE has examined a number of production options, and seems to be leaning in favor of a dual track strategy to examine both the purchase of tritium from private commercial reactors, and the construction of a proton accelerator for tritium production. A number of other alternatives were considered, including the construction for DOE of a new nuclear reactor dedicated primarily to tritium production. I am hopeful that today's hearing will provide some insight into DOE's reasoning for adopting its dual track strategy and provide the Subcommittee with some helpful information on the power generation and health and safety impacts of the various options. It will also be constructive to learn the results of the work of the Speaker's Task Force on Nuclear Cleanup and Tritium Production in this area, and to hear their recommendations for DOE's further action.

Again, Mr. Chairman, I appreciate your holding today's hearing and look forward to the testimony of our witnesses.

Prepared Statement of Hon. Michael Bilirakis, a Representative in Congress from the State of Florida

Mr. Chairman, it simply is essential that our Nation resolve its problem of securing a stable source of tritium production. We are here today to review the proposals of the Department of Energy in that respect and I commend you for holding this important oversight hearing.

The larger debate of how much nuclear defense potential is enough may be settled at another time and place, but as long as the American people rely—even partially—on a strong, safe and viable nuclear deterrent, tritium production will remain a crucial factor.

This isotope of hydrogen gas, which is used in each and every nuclear warhead in our arsenal, has a relatively short half-life in nuclear terms of 12 or so years and must be replenished regularly. However, as we all know, we have had no defense tritium production in the United States since the Savannah River facility shut down in the late 1980s. Since then, we have relied upon recycled tritium from other warheads to maintain our deterrent. However, this is not acceptable in the long term.

While our requirement for a viable nuclear deterrent may have decreased with the end of the cold war, I stress the fact that it has *not* ended, as some maintain. In this respect, I recommend to your attention the danger of releases into the world market of nuclear material in the wake of the break-up of the Soviet Union, as well as the ever-increasing threat of non-nuclear nations to obtain or develop this potential.

Also, I point out a recent report in the *Defense News* that cites a growing global threat of ballistic missile proliferation. That report notes, in part, that "the spread of nuclear, chemical and biological weapons, and the missiles capable of delivering them, remain one of the world's major security concerns..." furthermore, it goes on to point out that "...proliferating nations prefer the ballistic missile because of its range, speed and low cost, relative to manned aircraft."

Mr. Chairman, the nuclear threat to this Nation has *not* gone away, and we must be prepared for it. While the Committee on National Security has primary jurisdiction over these matters, falling within the scope of this subcommittee is the important component of ensuring the health and safety of nuclear facilities, as well as licensing and power generation issues.

For this reason, I welcome our witnesses here today, and I look forward to their testimony.

Mr. CRAPO. And now we will get to the first panel. And we welcome you, Mr. Graham and Mr. Ensign, to the panel, and we will start out with you, Mr. Graham. You can make your opening statement.

STATEMENT OF HON. LINDSEY O. GRAHAM, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF SOUTH CAROLINA

Mr. GRAHAM. Well, thank you, Mr. Chairman. I am really looking forward to being here. I never would have believed that an isotope of hydrogen would have dominated my life since——

Mr. CRAPO. You might want to pull that mike a little closer.

Mr. GRAHAM. I said I never would have believed that an isotope of hydrogen would have dominated my life, but it has.

As to Mr. Markey, it may make him feel better that during the time of the government shutdown, I have agreed to give my money to charity, so maybe it won't be a total waste on my part, and I would challenge you to do the same. That would be a good thing for us down here in Congress.

Mr. MARKEY. It is better than just throwing it away on a reactor.

Mr. GRAHAM. I agree, I don't want to throw money away; that we will agree on.

Let's talk about a few things that have gone on with the task force. Why are we doing this?

Tritium is important. If you are going to have a nuclear weapons deterrent force, you need a ready supply of tritium, and who can tell you what the needs are? The customer is the Department of Defense, and we have testimony to indicate that in the year 2011 we will need to have tritium production available—apparently, the half-life of tritium is about 12 years—and that depends on if the START II treaty gets implemented. If that treaty doesn't get implemented and we can't reach an agreement about our nuclear weapons needs, the tritium supply needs may be as early as 2005. So there is some debate upon that, but whatever we do we need to get on with it.

And let me tell you about the exhaustive search that the Department of Energy has made to find the right technology to help the American taxpayer. They spent about as much time being fair as when Bill Clinton came up with the 5-year balanced budget. They haven't spent any time looking at this in a fair way, and the reason I know that is there is a paper trail that goes back to 1994 indicating that the tritium production is going to come about through a linear accelerator.

That decision has been made a long time ago in the Department of Energy. I think it reflects a very antinuclear bias that the Department of Energy and its chief cohorts are not very in to making nuclear weapons. That is not really their agenda. Their agenda is not to get into the nuclear business at all. I believe that is their bias, and I publicly state it.

The country's needs are, produce tritium in a timely manner at the lowest cost to the taxpayer, and the vote that we had in the House had nothing to do with rejecting the triple-play reactor.

Let me tell you why the National Taxpayers Union came out against the amendment. The reason they came out against the amendment that was offered from the Department—from the National Security Committee is because the budget called for a $50 million allocation to study a new tritium source. The committee, on their own, went up to $100 million, going over the original budget numbers. They objected to that as a budget increase.

The National Security Committee put the extra $50 million in there so that we would have adequate funds to get on with developing a new tritium source. It had nothing to do with the triple-play reactor or the economic viability of the triple-play reactor, and the reason I know that is because I called and asked. They don't even know what the triple-play reactor is, but they do know that 100 is more than 50.

If the DOE has made a decision about the accelerator and hasn't looked at the reactor options, the question is, why? I think the question is answered simply by saying that they do not want to do anything nuclear, that the Department of Energy will never, ever agree to build a new reactor in this country for any purpose, no matter how cost effective it might be, no matter how timely it might be to produce tritium.

When you look at their independent report, it clearly shows that the most expensive option available to produce tritium is through the accelerator option. As far as I know, the accelerator has never been in production to produce anything. It is an experimental technology with a $200 to $300 million a year power supply cost, and you are either going to run this thing by hooking up to a nuclear power plant or building a fossil fuel plant of gigantic proportions, because it costs so much energy to operate.

The lifetime cost of an accelerator far exceeds any other available option. It is not cost that is driving this train; it is a bias that is driving this train.

When I make a decision to vote in this body, you have got to look at two or three things at the same time. Our national defense needs demand that we get on with tritium production. We should not spend over the next 2 or 3 years $300 million to look at an experimental technology that is the most expensive option available, and we don't even know if it works. That is not a good deal for the American taxpayer; that is not a very good deal for the customer, the Department of Defense. If you are serious about producing tritium, it seems to me that you would want to pick a technology that you know works when the needs are critical.

What do we know works? We know that heavy water reactors produce tritium because they have done it in my district for 40 years and they have won the cold war because we have stayed strong under Ronald Reagan. We are now looking at a new source to produce tritium. You are either going to buy, build or rent. You are either going to build a new technology, what could be the accelerator or the proposed multipurpose reactor, or you could rent or buy an existing commercial reactor in the short term. That is the proposal that is the least expensive option.

The problem with that potentially is this: If you buy an existing reactor, it is already built, it has been up operating, its useful life has been cut down a certain percentage. You are not going need tritium for at least 8 to 10 to 12 years. By the time you go into production mode, the lifetime of the reactor will be reduced even more. That is like buying an old car, fixing it up and only drive it 10 years from now.

That may be an option that we need because our critical tritium supply needs are so urgent that we may need to go, in the interim, to a commercial reactor to irradiate existing tritium targets so our national defense needs can be met. I support that if the needs do become critical. And I know where a good reactor is at; it is right across the river, where—from the place that has made tritium for the last 40 years.

In the meantime, what are we going to do for the American taxpayer if we all believe tritium is really an important need—and I question some people if they really want to make tritium to begin with, because tritium is an essential component to maintaining nuclear deterrent force and there are people in this Congress who really don't want to do that. But if you really want to do that, you are going to pick a technology that will do the job and do it in the cheapest manner possible, cost-effective to the American taxpayer.

And one thing we have done on the task force is, we have done something new for Washington. We haven't looked at one issue in isolation we decided to look at several issues if we are going to invest $6 billion or more of the American taxpayers' money, and see if we can do a good job in other areas and combine missions. One thing that we found in this area, when we looked at tritium production, is that there are 26 tons of weapons-grade plutonium around in America with not really a plan to get rid of it.

If you are talking about proliferation issues, that concerns me. We have weapons-grade brass that somebody, somewhere, better do something with. Now, we can put it in the ground and hope it goes away for the next 100,000 years, or we can take it and convert it into a substance that is not dangerous to the world; and one ever the ways you can do that is, you can take it and burn it and convert it into commercial spent fuel, which is not a proliferation issue. We can use the reactor to do that.

How about the idea of taking that same reactor that you are going to need to make tritium, combine the plutonium disposition mission at the same site, at the same reactor, and save the taxpayers billions of dollars? That is only a novel thought in Washington, DC. American business people do that all the time, every day. That is what I am suggesting this committee do, look at all of this issue, not in isolation, but combine it with other national defense needs and waste issues, see if we can get the job done at a cost that is acceptable to the American taxpayer.

Thank you.

[The prepared statement of Hon. Lindsey O. Graham follows:]

PREPARED STATEMENT OF HON. LINDSEY O. GRAHAM, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF SOUTH CAROLINA

Late last spring, Speaker Gingrich convened a task force with the sole purpose of examining the issue of tritium production. The mission of this task force was to determine the most cost-effective, proven method for tritium production. As chairman of this task force, I assembled a report called "Getting on With Tritium Production" based on input by the members of the task force, meetings with the Secretary of Energy, as well as industry experts on the technologies being both proposed and opposed by DOE. Besides those discussions, numerous DOE documents (e.g. the draft PEIS for tritium supply and recycling, the Nuclear Non-Proliferation Treaty, the implementation plan for the long term storage and disposition of surplus fissile materials, etc.) were available to the Task Force. After consulting these numerous sources and pouring hours into generating its findings, the basis for our findings came down to two extremely important issues as they relate to the taxpayer and our nuclear deterrent capability: cost and feasibility. It is imperative that we approach these type issues with rational thinking, that accomplishes the defined mission in the most cost effective and technologically sound way. We must not allow technology to be driven by anti-nuclear bias or a perceived need to promote needless scientific projects to sustain our national labs.

I am not and have never claimed to be an expert in the area of tritium reduction, however, I have lived and worked in the private sector and do understand risk, government projects, money, the American taxpayer and the environment. If I have a bias, then it is the taxpayer to whom I am biased. The report you have before you contains a detailed history of the issue as well as a list of findings and recommendations. You may disagree politically or philosophically but it's hard to disagree with common knowledge, the facts, and plain reality.

The report recommends that the Department of Energy pursue tritium production by building a multipurpose reactor. This approach would allow us to fulfill several important needs for our country... to produce tritium, burn excess weapons grade plutonium and generate electricity which is a means to offset the government costs. Additionally there is a willingness in the private sector to become a financial partner in such a project thus greatly reducing costs to the taxpayer.

The Department of Energy has a well known anti-nuclear bias which has gotten in the way, in many cases, of sound policymaking. This administration seems determined to reject this approach to tritium production although members of both parties and in both houses have embraced this idea. We have a rare opportunity to satisfy our tritium needs, dispose of fifty tons of highly radioactive, highly proliferable weapons grade plutonium and do so using a reactor—the only proven technology.

Mr. Chairman, thank you for this opportunity to present our findings and I submit the full report for the record. I will be happy to entertain questions from the committee.

Mr. CRAPO. Thank you, Mr. Graham.

We will hear the opening statement from Mr. Ensign, and then we will open the panel for questioning.

STATEMENT OF HON. JOHN E. ENSIGN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEVADA

Mr. ENSIGN. Thank you, Mr. Chairman. I appreciate Mr. Schaefer for holding this hearing today.

Tritium production is very important to the national security, and we must carefully consider all of our options. As a member of the tritium task force, I have worked very hard with my colleagues and appreciate the hard work and efforts that the tritium work group of the nuclear cleanup and tritium production task force has put forth.

As you know, Mr. Chairman, I have some significant problems with specific aspects of the task force's report. First and foremost, I believe that whatever mode of tritium production, whether it be reactor or accelerator, the decision must be based on the best science and technology available. I firmly believe we must reap the most benefits possible from our taxpayers' dollars by analyzing the costs and environmental impacts and future technological advances.

The Department of Energy is currently conducting an open public evaluation process under the congressionally mandated National Environmental Policy Act. This process is scheduled to produce a record of decision this month. The process should be allowed to continue.

An emergent concept from this process is to resolve technological and policy issues with both the reactor and accelerator through a dual-track developmental process. This dual-track process would result in a final selection of a production methodology several years from now which is based on fully demonstrated technology, and in the case for a reactor option, fully accepted designs by the Nuclear Regulatory Commission.

It is significant that the technology demonstration phase of this program is a necessity for either reactor or accelerator production of tritium, and therefore, does not increase the time necessary to commence production of this vital material.

Tritium for nuclear weapons has never been produced from light water nuclear reactors, and there is technology development necessary to accommodate this method of production. Accelerator technology and the associated tritium production neutronics are clearly feasible technologies. Accelerators have operated efficiently and safely for many years; numerous reviews of the accelerator production of tritium, APT technology conducted over the past few years by experts at the Metor Corporation, known as JASON, Lawrence Livermore National Laboratories have concluded that this system can be designed and constructed in time to meet stockpile requirements. A fully integrated demonstration, this method of production will further assure success prior to commitment to construction.

Furthermore, I feel the report does not accurately reflect all the information available concerning the two technologies. Many aspects of the accelerator were ignored, primarily the fact that the accelerator has minimal environmental impacts, where reactor-produced tritium has significant environmental effect.

The country has not resolved its long-standing issue with storage of spent nuclear fuels. For the government to contribute to the increase in high-level spent fuel through reactor production of tritium, while simultaneously debating and delaying the disposition of this continually growing supply of waste, is difficult to justify.

The task force report also inappropriately discounts the very real proliferation and domestic policy issues associated with mixing the production of nuclear weapons materials in commercial nuclear reactors. As the United States tries to influence other countries, such as North Korea and Middle Eastern countries, with respect to the use of reactors, we must carefully evaluate our policy associated with mixing the production of nuclear weapons materials in commercial nuclear reactors. These issues must be carefully dealt with in an open evaluation process before decisions are made to focus on reactor production of tritium.

Finally, it is not clear that the country needs another nuclear reactor at this time for any purposes advocated by the report—power production, tritium production or plutonium disposition. If the policy issues and technology demonstrated noted above can be addressed, it is conceivable that tritium could be produced in an existing commercial reactor or through the purchase of one of a number of partially or nearly completed nuclear reactors.

Let me just conclude, Mr. Chairman, by saying that while I realize that there are a lot of so-called “parochial interests” here—some people have said that the only reason Nevada wants the accelerator technology is because of the Nevada test site and wanting to locate it there—we also know that Nevada has no chance of getting an accelerator technology. So that is not the reason that I am here or take issue with the task force on some of these issues.

I am of the personal belief that we need to look at these issues openly. Cost certainly has to, you know, be looked at as a major factor, but we cannot discount safety as a major factor. We have to look at this in an open process. We can’t close the door on either side of the issue. We need to, in an open forum, debate the issues on how we are going to deal with the mixed-oxide fuels and whether we are going to mix with commercial reactors.

Does the Federal Government now compete with the open marketplace on developing the energy and, you know, selling energy? These are issues that need to be discussed in this whole process and, frankly, we haven’t even scratched the surface on talking about those issues.

Thank you, Mr. Chairman.

[The prepared statement of Hon. John E. Ensign follows:]

Prepared Statement of Hon. John E. Ensign, a Representative in Congress from the State of Nevada

Thank you, Mr. Chairman. I appreciate you and the members of the subcommittee holding this hearing. Tritium production is a very important national security issue that must be carefully considered. As a member of the Tritium Task Force, I worked very hard with my colleagues and appreciate the hard work and efforts that the Tritium Work Group of the Nuclear Cleanup and Tritium Production Task Force has put forth. As you know Mr. Chairman, I have some significant problems with specific aspects of the Task Force's report.

First and foremost, I believe that whatever mode of tritium production, whether it be a reactor or accelerator, the decision must be based on the best science and technology available. I firmly believe that we must reap the most benefits possible from our taxpayer dollars, by analyzing the costs, environmental impacts, and future technological advances. The Department of Energy is currently conducting an open public evaluation process under the Congressionally mandated National Environmental Policy Act. This process is scheduled to produce a Record of Decision this month. The process should be allowed to continue. An emerging concept from this process is to resolve technological and policy issues with both the reactor and accelerator through a "dual-track" development process. This dual-track process would result in a final selection of a production methodology several years from now which is based on fully demonstrated technology, and, in the case of the reactor option, fully accepted designs by the Nuclear Regulatory Commission. It is significant that the technology demonstration phase of the program is a necessity for either reactor or accelerator production of tritium and therefore does not increase the time necessary to commence production of this vital material. Tritium for nuclear weapons has never been produced from light-water nuclear reactors, and there is technology development necessary to accommodate this method of production.

Accelerator technology and the associated tritium production neutronics are clearly feasible technologies. Accelerators have operated efficiently and safely for many years. Numerous reviews of the Accelerator Production of Tritium (APT) technology conducted over the past few years by experts at Mitre Corporation (JASON) and Lawrence Livermore National Laboratories have concluded that the system can be designed and constructed in time to meet stockpile requirements. A fully integrated demonstration of this method of production will further assure success prior to commitment to construction.

Furthermore, I feel the report does not accurately reflect all the information available concerning the two technologies. Many aspects of the accelerator were ignored—primarily the fact that the accelerator has minimal environmental impacts, where reactor-produced tritium has significant environmental effect. The country has not resolved its longstanding issue with the storage of spent nuclear fuels. For the Government to contribute to the increase in high-level spent fuel through reactor production of tritium while simultaneously debating and delaying the disposition of this continually-growing supply of waste is difficult to justify.

The task force report also inappropriately discounts the very real proliferation and domestic policy issues associated with mixing the production of nuclear weapons materials in commercial nuclear reactors. As the United States tries to influence other countries, such as North Korea and middle-eastern countries, with respect to the use of reactors, we must carefully evaluate our policy associated with mixing the production of nuclear weapons materials in commercial nuclear reactors. These issues must be carefully dealt with in an open evaluation process before decisions are made to focus on reactor production of tritium.

Finally, it is not clear that the country NEEDS another nuclear reactor at this time for any of the purposes advocated by the report—power production, tritium production, or plutonium disposition. If the policy issues and technology demonstration noted above can be addressed, it is conceivable that tritium could be produced in EXISTING commercial nuclear reactors or through purchase of one of a number of partially or nearly completed nuclear reactors.

Mr. CRAPO. Thank you, Mr. Ensign.

And the Chair would first recognize the ranking member, Mr. Pallone, for 5 minutes of questions.

Mr. PALLONE. Thank you, Mr. Chairman.

I have to start out by saying that I—you know, it is a complicated field, and I am certainly no expert, or even close to it, in terms of understanding all the different aspects of it. But I just wanted to ask a couple questions, sort of general questions.

One is, the way I understand this basically, the DOE in its report that came out in October talked about two options; one is using an existing commercial reactor which, as Mr. Graham said, could be bought or rented, whatever. The other is to build a new type of tritium plant—not a reactor, but an accelerator, okay?

I guess my impression was—and maybe we will have to wait for Mr. Markey's comments on that—that this other option of building some new type of reactor, including this triple-play, was off the table; and so I hadn't even addressed that in my opening statements because I thought we were concentrating on the two DOE options.

But I understand that the task force report came out before the DOE's report, and so I guess I have two questions. One is, what is the interplay? In other words, did the task force subsequently analyze the DOE report and is there something new that the task force is saying as a result of that? That is question No. 1.

And the second question is about the money aspect. In other words, you know, if you use an existing commercial reactor, it seemed to me, based on your used-car analogy there, or whatever, that that is going to be the cheapest way to go. And I don't really think—I haven't seen any really convincing case yet.

I know that you, to some extent, were trying to make it that we should go into this—you know, new type of reactor, triple-play, whatever, which seems to me because it is new and hasn't been done before, is undoubtedly going to be very expensive. So, first off, how does your task force interplay with the DOE report; and second, just address the funding, because it just seems to me that the cheapest option is to use the existing commercial reactor.

Mr. GRAHAM. Very——

Mr. PALLONE. I know you tried to address that a little.

Mr. GRAHAM. Very good questions. For those of us who have followed tritium development for a while—and I did during the campaign and since I have been in Congress—it is widely known that the accelerator was going to be the preferred new technology that the Department of Energy—and I asked Ms. O'Leary, "Would you consider a multipurpose reactor?" and she said, "No." I will give her credit for that.

I asked her that months ago, when we had a meeting with Mr. Norwood, "Would you consider this as an option to produce tritium?" and she said, "No." I think she was being honest with me. She doesn't want to build a new reactor.

And I can understand what John Ensign is saying. If I was going to take all the nuclear waste in this country, I wouldn't be excited about any technology that would produce potentially more waste. The problem is that the accelerator will also do the same thing.

Let's get back to your question about what the task force did. There is an independent study of the Department of Energy commission that was put out in September, and they looked at the multipurpose reactor. They looked at a gas reactor, they looked at existing commercial reactors, and they looked at a heavy water reactor and the accelerator. And you will find on page 5 of that report that the most expensive technology, independently analyzed, was a gas reactor.

They said it had a high cost of $16.3 billion; that the accelerator was a low cost of $6.4, with a high cost of $14.8; a new light water reactor multipurpose reactor would be from $2.5 to $10.1, about a $4.5 billion difference. According to their independent analysis, the new light water reactor would be $4 to $5—$4.5 billion cheaper than an accelerator.

Now, the Department of Energy's independent commission looked at this technology. My concern is that the Department of Energy itself has never considered the technology because of the biases I tried to lay out.

The commercial reactor as an option really came in at the last part of the game when it looked like the numbers for the accelerator were going to be very large. And if you don't want to build a new reactor, you have got to have a fallback plan, and one of the fallback plans would be to take an existing reactor and irradiate tritium targets to, in the short term, keep our needs supplied.

But that is not a long-term tritium production possibility, in my opinion; it is a fallback plan. It has been viewed by the Department of Energy as a fallback plan, and I support their efforts to explore it.

All I am asking is this. I know the Department of Energy is not going to consider the multipurpose reactor. The independent group D, they show it is much cheaper. When you look at the plutonium disposition mission and combine it with tritium, it even becomes more cost effective.

The money being allocated in our budget to study tritium production, 90 percent of it is going to go to the accelerator development; no money is going to go to looking at the multipurpose reactor option. And all I am asking this committee to do and Congress to do is to create a level playing field with the production moneys available, look at the accelerator, because it would be nice if we could come up with a technology that did not produce waste.

But this is uncertain. It has never produced tritium or anything else at all.

Our national defense needs are pressing. Let's put some money aside for converting existing commercial reactors as an option. Let as look at the multipurpose reactor and see if it will work, see if it will be cost effective, and still pursue the accelerator. That is all I am asking. It has never occurred.

Mr. PALLONE. That is what I am asking, and you agree; and the report basically says, the use of an existing reactor is cheapest, but you say that is sort of a stopgap measure.

Mr. GRAHAM. It has been billed as a stopgap measure. If our tritium supply needs become more critical, I think we need to look at that option harder. If it is 2005 and you try to build a new reactor and accelerator—see, we are still in the experimental phase with the accelerator. I don't think anyone doubts that you can make tritium with a light water reactor. There isn't any doubt about that. We have done it with heavy water reactors.

Mr. PALLONE. Just one thing, if you don't mind. The task force didn't come to a conclusion about any of these things. Basically studied it, but didn't conclude any particular way to go?

Mr. GRAHAM. Right. Let me give you Lindsey Graham's personal bias, and this is just to me as a Congressman. I have looked at this issue far more than I really want to look at it, but since Savannah River is such a big part of my district, the accelerator as a technology, as the tritium production source, will come to Savannah River because the infrastructure to make tritium is there.

I admire John for saying that he is not here trying to argue for a technology in his district, accelerator would come to the Nevada reactor. No matter what we do, it is coming to South Carolina. I didn't get elected to build anything in my district no matter what it cost. I want to build the right thing in my district for our Nation and that is my concern, that we look at all these options fairly; and I don't believe that has been done. And that is my recommendation, to look at them all.

Mr. PALLONE. Okay. Thank you.

Mr. CRAPO. The time of the gentleman has expired and the Chair will next turn to the gentleman from Kentucky, Mr. Whitfield.

Mr. WHITFIELD. I have no questions.

Mr. CRAPO. Thank you. And the Chair would next turn to the gentleman from Massachusetts, Mr. Markey. Do you desire to ask questions?

Mr. MARKEY. Yes, thank you, Mr. Chairman.

You know, the problem that we have with this kind of congressionally driven technology decision is that on the one hand, we have market forces at play in terms of the pricing of electricity and the most effective way of generating it for the next 20 or 30 or 40 years, given the fact that this committee is right now engaged in a widespread discussion of legislating in the area of retail wheeling, repeal of PUCA and PURPA, along with the Trust Indenture Act and other activities that clearly are going to impact upon Wall Street's view of whether or not this is a good investment in terms of the most efficient way to generate electricity in the private sector.

On the other hand, we have testimony from the Department of Defense and the Department of Energy from a national security perspective, looking at all of the costs in a constrained budget environment with regard to what is the best way they can expend limited funds.

In addition, I think we have to look at it in the context of arms control discussions that are under way, and that we expect to be undertaken in the years ahead. If START II is ratified, then indeed, we have a much longer timeframe in terms of looking at this issue. If a follow-on agreement is reached, the need for additional tritium reactor—tritium capacity would be pushed out to the years 2020 to 2030 and perhaps beyond.

Now, all of this, of course, impacts upon the decision which we are making, because looking at it today, we would have reasonable expectations that there is going to be a highly volatile domestic electricity marketplace with the lowest-cost generator being rewarded increasingly and this committee helping to make that the case through our desire to remove any of the protections which monopolistic utilities have and, at the same time, with a little bit of luck, increasingly stable environment in terms of our need to produce new generations of nuclear weapons. And that is why I look at this as a very difficult, but ultimately pragmatic set of decisions that we have to make with Wall Street on the one hand and, thus far, very successful arms negotiations on the other, pushing us in a direction which I think the administration has wisely adopted and was reflected in the amendment on the floor.

And I respect the gentleman from South Carolina in terms of his efforts to put together a task force to bring this case once again before us. But on the other hand, I just think that we have to be mindful of these pressures; and I would like to get a sense from the gentleman from South Carolina, if I could, as to how he views this retail wheeling phenomenon and the impact that it is going to have, without question, upon the viability of a nuclear project when Wall Street hasn't invested in a new nuclear power plant for 20 years, and the pressures that we are going to help to apply will make it even less likely that we will see that as the direction in which Wall Street will be going in terms of favorable treatment of new energy generating sources.

Mr. GRAHAM. A very good question.

What we have to look at is what this project will accomplish for the Nation; and one of the benefits, in theory, is that when you make the tritium and you dispose of the plutonium by burning it in the reactor, that you can sell electricity from the power of the reactor to lower the cost. I am looking at the National Nuclear Energy Institute report that says new demand for power—that if we have a moderate annual increase of 1 to 2 percent, we will need 200,000 megawatts of new generating capacity by the year 2010. But that is a very realistic thing to look at when you are trying to put together this private consortium to build the reactor, which would be off budget, where private companies would build the reactor, charge a fee to the government to produce tritium, a tipping fee to burn the plutonium.

They have to look at power supply needs, and we will have to evaluate it along the lines of what Mr. Markey is saying: Are those realistic numbers? Are they selling us a bill of goods? I agree that that is what we need to look at when they come out with a proposal, the power generation part of it needs to be analyzed in terms of what the market is all about.

But I do know this. We have 26 tons of plutonium sitting in this country, and if I was John Ensign, I would not want to receive it in weapons grade form; I would want it to be in a more stable form. And one of the things that we can do is burn it and convert it into commercial spent fuel, and we can even take the commercial spent fuel and reprocess it.

Mr. MARKEY. Can I say, Lindsey, the North American Liability Council acknowledges there is a glut of electricity in the south and that there is the projection of a glut in the future in the southeastern part of the United States; and I am just trying to look at this realistically in terms of what the likelihood is, in the marketplace, Wall Street will invite investors from around the globe to be pouring more money into the most troublesome of all technologies in a marketplace that is going to become increasingly overloaded.

Mr. CRAPO. The time of the gentleman has expired. If the gentleman from South Carolina would like to respond.

Mr. GRAHAM. Just very briefly. Those are good questions, they should be asked. We will never know the answers to these questions until we allow a private consortium to get together and offer us a plan that we can look at the details and see if they make sense; that is all I am advocating. Because if it would work, Mr. Markey, if we could build this power plant with private funds and paying a tipping fee each year for plutonium disposition, tritium production, it would be a tremendous reduction in costs to the American taxpayer and it would fulfill our tritium production needs and waste disposal needs. It is worth looking at.

But that is a very good question. We will never know the answer until we seriously look at this issue.

Mr. MARKEY. This Swedish company, though, their whole premise is that it will be privately financed and that they will be able to sell nuclear power. That is the whole premise of ABB's proposal.

Mr. GRAHAM. Duke Power is also in that consortium, and let's see if they can come up with a plan that makes some sense.

Mr. MARKEY. That is their plan, though.

Mr. CRAPO. The time of the gentleman has expired.

The Chair will next turn to the gentleman from Georgia, Mr. Norwood.

Mr. NORWOOD. Thank you, Mr. Chairman. I appreciate that.

Gentlemen, thank you for your testimony.

Mr. Graham, I think you and I both know that the debate is not over where any new tritium production will go. I will be delighted to face off with Mr. Markey on that if it comes up. In fact, it will be fun. There's nowhere else to put it. So we are not, I think, sitting here saying, well, we are here trying to make sure this production goes to South Carolina. However, I think we are, and our task force has been, very correctly concerned with the cost to the American taxpayer as to how we produce tritium.

I will jump over the question as to whether those in the Energy Department really believe we need tritium or whether they have a total bias as to how to make tritium. Frankly, Mr. Markey, part of their bias is what is driving the congressional technology decisions, because they seem to be very closed in their thinking.

But, Mr. Graham, if you will tell me the differential in the cost in producing an accelerator, if that would work, versus producing a triple-play reactor, I would appreciate it.

Mr. GRAHAM. All right. Let's go back to Mr. Markey's question and, for a minute, get back into the area of where this project is going to be financed by government funds on budget that we give up on the private option and we just go to spending taxpayer dollars.

According to the independent analysis by Putnam, Hayes and Bartlett, when you do not even consider power sales to offset costs, that is not a consideration, the top-end cost for an advanced light water reactor would be $10.1 billion. The top-end cost for the accelerator would be $14.8. The bottom cost for a light water reactor is $2.5; for an accelerator, $6.4. So you are looking at between $4 to $4.7 billion differences.

Mr. NORWOOD. Are these the same figures that the Department of Energy and Ms. O'Leary have come up with?

Mr. GRAHAM. Yes. Well, this is their report—this is the independent consulting firm that she hired to look at the options, and this does not consider power sales at all.

Mr. NORWOOD. If you consider power sales, what is the differential?

Mr. GRAHAM. That the consortium is willing to look at this indicates that power sales would make it financially attractive for a company to get into this endeavor so that they would get a fee from the government to produce tritium, they would get a fee from the government to burn plutonium. They would also have the ability to sell power. They believe the power market in the southeast, which, you know, is growing probably faster than any other region in the country, makes it economically viable.

I agree with Mr. Markey, we need to look that report and see if it makes sense; but we have got to get a report to look at, and I am willing to invest some money to get that report done.

Mr. NORWOOD. Is $6 billion somewhere in the neighborhood of a correct number?

Mr. GRAHAM. Yes.

Mr. NORWOOD. In the amount of power you would sell?

Mr. GRAHAM. I don't have the numbers with me. I have got a report that talks about what the fee for plutonium disposition and tritium production would be.

Mr. NORWOOD. Tell me why then if we are talking basically about a turnaround of about $10 billion over 40 years, why in the world would the National Taxpayers Union be trying to save $50 million when we were trying to save $10 billion? Do you have any understanding of that?

Mr. GRAHAM. We have become Pavlovian dogs in Congress. If it is a dollar more than the budget says, even my class—I am a Republican freshman coming up here to cut spending—we will just blindly say, No, that is too much money.

The $50 million that was added in by the National Security Committee to increase the funds available to study tritium production, I thought was a wise move, because that extra $50 million allows to us look at more options, very seriously, to save billions.

But the National Taxpayers Union saw the increase from $50 to $100 and said, no, that is not the way we want to take the country. I respect that, but I think that was short-sighted.

Mr. NORWOOD. Well, Mr. Graham, I heard during that debate my good friend John and Mr. Markey say 100 times how important it was for us to listen to the National Taxpayers Union, because they wanted to save $50 million and they didn't even have enough information to know we were trying to save $10 billion.

Mr. GRAHAM. I called them and asked them, What is your problem with the technology choices? They didn't even know what the technology choices were. They just looked at it from a budget increase perspective, and I can understand that.

What Mr. Markey is saying is true, this is a complicated issue. We need to look at everything available and make a good decision; and I can honestly tell you from my perspective, that has not occurred to this date, and Congress needs to insist that it occur.

Mr. ENSIGN. Mr. Norwood, may I respond?

Mr. NORWOOD. Certainly.

Mr. ENSIGN. First of all, we know why the $50 million is, because the $50 million was added beyond what was—what the committee had recommended, and the $50 million was basically for a foreign company to sell this idea. But that isn't what I want to address.

What I want to address is, you look at the history of our government and the way we do business, you get this triple-play reactor starting to be built and the initial projection costs are, let's just take, for example, $4 billion. Now we are getting to the point where it is getting kind of critical. We are about 2 years away, and all of a sudden they say, well, we have cost overruns. That is going to be about $8 billion now.

The way our government works is, we give them $8 billion. That is one of my biggest concerns. That is one of my—or $10 or $12 billion, or $15 billion.

Yucca Mountain, remember how much Yucca Mountain was supposed to originally cost? $200 million. Now—how much is Yucca Mountain now projected, $30 billion?

Mr. NORWOOD. I understand. That is our job, to see if we can't write a contract that doesn't allow that kind of thing to happen, John.

Mr. ENSIGN. I don't care how you write it, no matter how you write it and they say, well, if you don't come through with it, you are not going to have this thing.

Mr. NORWOOD. I wanted to—one last——

Mr. CRAPO. One quick question.

Mr. NORWOOD. Thank you. One last point.

It seems to me that Wall Street has stayed away from reactors, Mr. Graham, because we have made it so very difficult in this country to build one. We have caused the cost to go out of sight where it is not real probable to build one. But I know Mr. Markey doesn't know about Plant Vogtle, where Wall Street just finished investing in it in 1987, so it hasn't been 20 years since Wall Street has been involved. But if we would work on this a little bit, Wall Street would get very involved.

Thank you, Mr. Chairman.

Mr. CRAPO. Thank you, and we are going to try to do another real quick second rounds of questioning.

Does Mr. Pallone have any further questions?

Mr. Whitfield?

Mr. Markey?

Mr. MARKEY. Yes, thank you. Thank you, Mr. Chairman very much.

The Vogtle plant—I mean, just for clarification for anyone who might not be familiar with this estimable project, is one which is a continuation from an earlier generation. 1987 was perhaps the last financing step that they made, but it was a plant that was ordered in the 1970's, which was the point that I made, which was that Wall Street hasn't invested in any new nuclear power plants in the United States since the 1970's. And as you know, this committee in 1992 completely overhauled the nuclear licensing procedures for the country. It is one-stop shopping now, and they have been free out on the marketplace for the last 3 years if they—that is, any private utility—want to invest in nuclear power, to do so. None have done so.

But I don't think that you should in any way hold against the private sector their evaluation of the gross mismanagement of the nuclear management power option over those many years, and even with the help that we have given it in the last 3 years in this committee, they still haven't been able to go back into that marketplace.

You know, there is an old Mark Twain saying that when a cat burns itself on top of a stove, sure enough, it won't jump back up on a hot stove; but it won't jump back up on a cold stove, either. And more and more they are moving over to alternative means of generating electricity.

The fear which the Department of Energy has is that there is a high likelihood that they are going to wind up becoming a kind of umbilical cord, life support system for this private reactor because of their need for the tritium that will be produced from it, and that we won't have a competitive marketplace; but, in fact, we will have a government-subsidized electricity generating facility plopped right into the middle of the southeastern part of United States with a national defense cover for its existence that would warp the competitive marketplace for electricity while at the same time keeping the Federal Government in on a permanent basis with additional subsidies. And we should just be realistic about what the likely cost—course of action will be.

I just don't think it is competitive, and it is also very hard for me to stand by and watch the National Taxpayers Union be maligned, too. I mean, that is my favorite organization in the country, and when I hear Republicans constantly attacking it, you know, I think the vigilant oversight they give on the excess spending in Congress, it just—it just—it breaks my heart, it really does. I hate to see you guys turn on such a wonderful organization. So the—and I am proud of the——

Mr. CRAPO. If the gentleman would yield briefly.

Mr. MARKEY. I would be glad to.

Mr. CRAPO. I am consistently in opposition to the organization. I am not going the change.

Mr. MARKEY. I remain, as do most Republicans, open minded, depending upon the issue.

So the—this is not anything that, in my opinion, we should be rushing into. I think the House, in its wisdom, made a wise decision; and John, I would like, if you could, for just, you know, a minute or so—just give us the summary, the summary statement of what it is you want us to remember as we leave and go on to the next panels, in terms of the need for this project.

Mr. ENSIGN. Well, I think that, first of all, there are licensing issues with this, with the triple-play reactor that certainly nobody has the answers to, exactly what we are going to do with that.

There are so many unanswered questions that—and I thought you brought up an excellent point in the whole idea of, how much tritium do we need? We have to answer that. We have to answer the questions of cost. We have to answer the questions of public safety. We have to answer the questions of environmental impact. All of that, not just cost, has to be taken into account.

If cost was the only factor, you know, we wouldn't have a military, so—obviously, I am a strong proponent of having a military. It costs us a lot of money even during tough budgetary times, but cost is not the only factor. There are a lot of other factors that we need to take into account.

New technologies along the way, there are so many possibilities with the accelerator technology that I think that at least it has to be studied and given a fair shot. Obviously, there needs to be a stopgap measure for tritium production if, indeed, we do need that; and we have to look at that—look at that as well.

So all of the options, I think, have to be looked at, discussed in a public forum as much out of the Congress, as far as politics is concerned, as possible, which is very difficult to do.

Mr. MARKEY. I think that is an important point, and I will just conclude with this, that no one denies that we need a dependable, long-term source of tritium. We are debating over exactly how to develop a source capable of meeting our national security requirements and what the most cost-effective way of doing so would be.

Now, I might note, in conclusion, that I know that the Speaker is talking about how obsolete the whole committee system may be in Congress; and of course, the work that we have done over the last 20 years on most of these issues and the energy issues generally is suspect, as is any other activity of the traditional committee system. But I would hope that this task force that has been constructed is not the model that he is thinking of replacing a committee of expertise with. To handpick a small number of Members from one party to develop recommendations from information and sources that are unexaminable by others who weren't allowed to participate, in my opinion, is not the proper way for us to be deciding these very important issues; and I hope that it is not a model for what he has in mind for replacement of the committee system as he begins to have—as he continues to have this open, you know, public dialog about whether or not the committee system should be modified.

And I thank you, Mr. Chairman.

Mr. SCHAEFER. The gentleman's time has expired.

The Chair would recognize the gentleman from Georgia, Mr. Norwood.

Mr. NORWOOD. Thank you, Mr. Chairman.

Mr. Ensign, just a couple of questions. What you said, you were concerned about the licensing issues with the reactor. What do you mean by that?

Mr. ENSIGN. Well, the whole idea of the triple-play reactor and the licensing, you have the idea of using weapons grades plutonium in a manner that is not currently being used. It does bring up some licensing issues that are not currently—this has never been done before. There are going to be some complexities in there.

This potentially is in conflict with the current policies within the United States of mixing, you know, commercial with military purposes, and so we have to address that. Is that something we want to go forward with as a country? Is that going to affect our discussions with countries like South—or like North Korea, with some of the Middle Eastern countries, on what we want them to do with their nuclear power?

Mr. NORWOOD. Is anybody in the world doing this type of thing?

Mr. Ensign. Not—not in the way that 100 percent mix oxide fuels are doing it. France is doing it where they have a third, but nobody is doing it with 100 percent.

Mr. Norwood. Close, though.

Mr. Ensign. It is one-third.

Mr. Norwood. England?

Mr. Ensign. That is what I am saying, nobody is doing it with more than a third of mixed oxide fuels.

Mr. Norwood. The DOE has clearly shown its bias for an accelerator, and I am curious to see if you know how much money they have spent on the research and design of that already.

Mr. Ensign. No, and I would agree with—I would agree with this committee. I am not here to defend the Department of Energy; I have been one of its harshest critics and have recently called for the resignation of—you know, the firing of Hazel O'Leary because of some of the things that she has done. I think it is a very poorly run organization, and I will not in any way defend the Department of Energy.

I think that perhaps they have done some bias in their leanings toward the accelerator technology. That does not mean that it is not an acceptable technology, just because they happen to be biased toward it.

Mr. Norwood. Do you have a comment?

Mr. Graham. I agree with John. It does not mean it is not acceptable technology, nor does it mean the triple-play reactor is not acceptable technology. We won't know until we look at it. And the fair shot that was mentioned during the last round of discussions has not existed to this day.

The independent analysis clearly shows that the advanced light water reactor, with government funding, no private funds involved, is $4.5 billion cheaper. We are passing up certain technology to go to uncertain technology that is clearly more costly. That is a model of government that has existed for 40 years that needs to be changed. We need to look at the numbers, look at the independent report and not go jump to the decision.

They made a decision on the accelerator in October 1994, a year before the report came out, and I do believe there is a bias here. But if I was John Ensign, I would be very leery of supporting a technology that created waste, because his State is probably going to receive this waste.

I support the efforts of this Congress to send waste that is in the most stable form. Let's clean up our waste stream, let's reduce it before we sent it to anybody.

We do not have a comprehensive energy strategy. Nuclear—commercial spent fuel is overflowing in this country. We need to get a central depository, but we need to look at cleaning up the waste stream from defense waste and commercial waste before anybody takes it; and I am advocating that.

But as far as tritium product, I believe we can combine that mission with the mission I just spoke of and help everybody in the country and save a lot of money; but we are taking a commercial reactor and making tritium with it. Even under the Department of Energy's plans, tritium is a nonfissile fuel substance; it is not something you could go out and make a bomb with, so that is really not an issue here.

Mr. NORWOOD. So we all seem to agree we need to look at this carefully.

Mr. ENSIGN. Let me just make one point and that is that with a lot of issues up here, everybody seems to have a bias, okay? I don't want to see this thing go down the line where it is biased toward triple-play, either.

What I am saying—that is why I mentioned in my opening statement that the best science dollars, budgetwise, but also for safety, environmental concerns, they all have to be taken into account; and if we can take it away from the political process, because this body—this committee in particular, okay—certainly did not take into account, as judged by when I was testifying in front of this committee on Yucca Mountain, no one could—no one challenged and no one could challenge the assumptions that I made, the budgetary, the scientific assumptions on nuclear waste and how to store and what the best way is. And yet this, from a purely political standpoint, the politics got involved, and that is what I am afraid is going to happen with this, that politics will drive this issue—not good sound science, not budget, not public safety, not environmental factors.

Mr. NORWOOD. Mr. Graham, the $50 million, we are talking about 90 percent of it going for research on an accelerator?

Mr. GRAHAM. Ninety percent of it has been programmed to go out to look at the accelerator, which, again, is an unproven technology—clearly, the most expensive of the options available according to this independent report which was, hopefully, nonpolitical.

Mr. NORWOOD. So the best thing we are going to get out of this hearing today is, we are going to know now that Mr. Markey and Mr. Ensign are going to help us go back and make sure that all of that $50 million, 90 percent of it, doesn't go to the accelerator because they both said they want the look at all options.

Mr. GRAHAM. Right. I hope so.

Mr. NORWOOD. Let's research it. Why don't we divide that $50 million and put it into each of the three areas we want to research? We appreciate your help.

Mr. GRAHAM. Let me talk about the accelerator.

The power supply needs of an accelerator can run as high as 300 million megawatts a year. You are going to either hook it up to a nuclear power plant, which will create waste, or you are going to do it by fossil fuel; and they tell me—now, I am not an expert, but here is what the report says—that to run an accelerator every year would take 250 miles of rail cars filled with coal.

Mr. NORWOOD. So, in closing, Mr. Chairman. I presume now that Mr. Graham and Mr. Ensign will help us divide these funds up so that everybody gets a fair shot.

Mr. GRAHAM. That is all I ask.

Mr. NORWOOD. That is all we ask.

Mr. GRAHAM. And I have got to go.

Mr. SCHAEFER. The gentleman's time has expired.

Mr. MARKEY. Mr. Chairman, could I ask for a triple-play round now, perhaps? Can we go for another round? Is that possible, the triple-play?

Mr. GRAHAM. We will do it on the basketball court.

Mr. MARKEY. All right.

Mr. SCHAEFER. We have had two rounds. I say to the gentleman that any other questions that we would like to ask will be submitted in writing.

I would now call up Mr. Charles Curtis, Deputy Secretary, Department of Energy, for his testimony.

Mr. Curtis, we want to thank you very much for taking time out of your schedule to be with us today. We had the time to talk a little bit at Keystone, and we certainly are looking forward to your testimony. So proceed as you may and, without objection, the entire statement of Mr. Curtis will be submitted as part of the testimony. So you are on your own.

STATEMENT OF CHARLES CURTIS, DEPUTY SECRETARY, DEPARTMENT OF ENERGY, ACCOMPANIED BY MAJOR GENERAL ELDON JOERSZ, DEPUTY ASSISTANT SECRETARY FOR MILITARY APPLICATIONS, AND VICTOR REIS, ASSISTANT SECRETARY FOR DEFENSE PROGRAMS

Mr. CURTIS. Thank you, Mr. Chairman. It is a pleasure to be with you this morning to discuss the status of the Department of Energy's program to provide tritium in support of the Nation's nuclear stockpile and to address any concerns and questions that the members of the committee may have.

First, let me be very clear and emphatic about the Department of Energy's commitment to provide tritium in the amount needed when it is needed for this Nation's national security requirement. In meeting this commitment, the Department is working with, and will continue to work closely with, the Department of Defense. That is DOE's ultimate customer and that is the customer that we must please.

Toward this end, our interactions with the Nuclear Weapons Council have permitted the Department of Defense to keep informed on and confirm our tritium program. Continued interactions with the Nuclear Weapons Council and with the Department of Energy implementation plans should assure the Congress and the American people that this sensitive national security responsibility is faithfully and effectively discharged.

As this committee is very much aware, the Department of Energy has taken steps over the last several years to study carefully the many options available for tritium production. We have looked at and reviewed these options in the context of a Programmatic Environmental Impact Statement (PEIS) process, as we are required to do under the law. This review has been complicated by the ever-changing tritium requirements brought about by the unfolding and unpredictable nature of international events.

The Department may not be required to produce tritium until 2011 or later, or it may be required to produce tritium as early as 2005. Not only is the timing of production uncertain, the amount of tritium to be produced on an annual basis is also uncertain. The uncertainties driving both the timing and quality are not within the exclusive control of the Department of Energy or even the Department of Defense. Although we could discuss extensively what a production schedule should be and how much should be produced—and we are prepared to do that, should the committee wish—the bottom line is that the Department must maintain flexibility, flexibility to meet future requirements, whatever they may be.

As required by the National Environmental Policy Act (NEPA), the Department has identified its preferred alternatives for tritium production. These alternatives have been discussed in earlier proceedings. They are namely: one, to utilize an existing commercial light water reactor to carry out this mission; or two, to build an accelerator system for tritium production.

In addition, we have identified the Savannah River Site as the preferred site for construction of an accelerator, should one be built. Subject to confirming this course of action in the Record Of Decision (ROD) of the final Environmental Impact Statement (EIS), it would be our preference to explore both alternatives: one, to determine expressions of interest and develop options for proceeding on the civilian light water reactor path; and two, to design, build and test critical components to prove the concept of utilizing an accelerator to perform this mission. The environmental impacts of this and other alternatives were reviewed in the final EIS that was published on October 20th of this year.

Under the National Environmental Policy Act, the Record Of Decision can be issued no sooner than 30 days following the date the EIS was available, and we do anticipate a Record Of Decision will be completed in just 2 weeks' time—by the end of November.

In order to implement the tritium decision, when it is made, the Secretary has authorized the creation of a tritium office to manage this program. It is with pleasure that I introduce the head of that office, Major General Eldon Joersz, who is on my left, to the committee. General Joersz is the principal Deputy Assistant Secretary for Military Applications. He has recently completed a tour of duty in Europe as the Chief of Staff, Headquarters Allied Air Forces, Southern Europe. We are very pleased to have General Joersz manage the tritium program, and I am honored to serve with him.

On my right is Dr. Victor Reis, the Assistant Secretary for Defense Programs, who has the ultimate program responsibility in this area. Let me point out to this committee, because there has been a great deal of discussion about bias, Dr. Reis has served both the Reagan and Bush Administrations in positions of importance. He has served on the Nuclear Weapons Council of the Department of Defense. He now has principal program responsibility for this area. I am also proud to serve with him.

The Department of Energy will use the next several years to lay out a program with costs and schedules that will fully accommodate the potential uncertainties. The Department will select a tritium supply capability based on tritium requirements and based on sound, peer-reviewed, scientific information.

While doing this, we all—the Department and the Congress—must be mindful of our fiscal responsibilities. The Department must meet its responsibility for tritium, but it must do so in a cost-effective way that will take into consideration the national security obligations of the Department. Cost is not the only criterion; the national security requirement is the primary imperative.

Mr. Chairman, I appreciate the opportunity to appear this morning and will be pleased to answer your questions.

[The prepared statement of Charles B. Curtis follows:]

Prepared Statement of Charles B. Curtis, Deputy Secretary, Department of Energy

OVERVIEW

Good morning Mr. Chairman and members of the Subcommittee, it is a pleasure to be here this morning to discuss the Department's actions to identify and select a new tritium supply source.

Nuclear deterrence remains a cornerstone of the nation's defense strategy. The President has stated "we will retain strategic nuclear forces sufficient to deter any future hostile foreign leadership with access to strategic nuclear forces from acting against our vital interests and to convince it that seeking a nuclear advantage would be futile. Therefore, we will continue to maintain nuclear forces of sufficient size and capability to hold at risk a broad range of assets valued by such political and military leaders."

The Department is responsible for ensuring the safety, security and reliability of the nation's enduring nuclear weapons stockpile. One key element in this equation is providing tritium to maintain our nuclear deterrent capability.

The purpose of my remarks this morning is to emphasize three important points, which I hope you will carry away with you today. First, the Department has undertaken an exhaustive process to reach a decision on how to produce the needed tritium. That process is all but complete. Second, we have developed what we believe is an excellent strategy to be able to provide tritium safely and reliably, when it is needed and we have a program to go with that strategy. Third, this strategy is supported by the Nuclear Weapons Council.

THE NEED FOR TRITIUM

Tritium, an isotope of hydrogen, is a vital component of every nuclear weapon in the U.S. stockpile. Tritium does not occur naturally in the quantities required, but can be produced in reactors or accelerators by the interaction of neutrons with a "target" material, either lithium or helium. As a result of its short half-life, 12.3 years, about 5.5 percent of the tritium inventory is lost each year through radioactive decay. The tritium that is lost through decay must, therefore, be replaced periodically. If the tritium is not replenished, the weapons would not perform as designed.

For several decades prior to 1988, the DOE nuclear reactors at the Savannah River Site had been the nation's source of tritium for nuclear weapons. Since 1988, when the last of these was shut down, the United States has not produced tritium. Adequate tritium has been available from retired weapons to meet Department of Defense requirements. During FY 1995, the Department filled 1503 tritium bottles to meet the needs of the enduring nuclear weapons stockpile.

The requirements for the supply of tritium are spelled out in the 1994 *Nuclear Weapons Stockpile Plan*, which represents the latest official guidance. The 1994 *Nuclear Weapons Stockpile Plan*, in turn, is based upon a weapons stockpile level consistent with the START II agreement signed in January 1993 by Presidents Clinton and Yeltsin but not yet ratified by either nation. Based on a stockpile size consistent with START II, the United States will need to have new tritium by about 2011 in order to meet stockpile requirements and maintain a 5 year reserve supply. It is possible, however, that tritium could be required as early as 2005 if implementation of START II is delayed or if ratification does not occur. The Department is committed to providing tritium whenever it is needed. Given the uncertainty, it is important to build flexibility into the planning process to meet contingencies. The preferred strategy that the Secretary announced on October 10, 1995, responds to this need by pursuing multiple options for the future tritium supply.

TRITIUM SUPPLY AND RECYCLE PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT AND ASSOCIATED STUDIES

Consistent with the National Environmental Policy Act, the Department has prepared a Tritium Supply and Recycling Programmatic Environmental Impact Statement (PEIS). The Department released the Draft PEIS on March 1, 1995, consistent with our commitment to the Congress. The Final PEIS was available on October 20,

1995. I am not in a position to announce a final decision today, but the Department will be in a position to issue its Record of Decision by the end of this month.

The Department has undertaken an exhaustive analysis of the various options for new tritium production. The analysis involved a huge amount of data, drawn from a variety of sources, and encompassed the environmental, cost, schedule and production assurance issues associated with each of the tritium supply, recycling and siting alternatives.

The PEIS analyzes four different technologies for a new tritium facility: Advanced Light Water Reactor (ALWR), a Heavy Water Reactor (HWR), a Modular High Temperature Gas-Cooled Reactor (MHTGR) and Accelerator Production of Tritium (APT). The PEIS discusses the impacts of these technologies at each of five candidate sites: Savannah River Site, Idaho National Engineering Laboratory, Oak Ridge Reservation, Pantex Plant and the Nevada Test Site. In addition, the PEIS evaluates the environmental impacts associated with the use of a commercial light water reactor (CLWR) to make tritium, through the purchase of an operating or partially completed reactor, or the purchase of target irradiation services. Finally, the PEIS assesses the impacts of the advanced light-water reactor, the high-temperature gas-cooled reactor and commercial reactors as multipurpose or "triple play" candidates. The "triple play" reactor is a facility that could assist in disposing of excess plutonium in addition to making tritium and generating electricity.

In parallel with the development of the PEIS, the Department carefully assessed the cost, production assurance and schedule issues associated with each of the tritium supply alternatives and the triple-play option. The data for and results of these analyses are summarized in a Technical Reference Report for Tritium Supply and Recycling.

Since cost is obviously a major factor in determining how best to provide tritium in the future, the Department retained the services of Putnam, Hayes and Bartlett, Inc., an internationally respected economic consulting firm, to perform an independent assessment of the work done by the Department regarding the cost issues associated with the various alternatives. The firm arrived at a potential range of costs for each tritium supply alternative, including ranges of costs for both a government-owned and privately financed multipurpose reactor.

COMPARISON OF ALTERNATIVES

Based upon the data and assessments reflected in the PEIS, the Technical Reference Report and the independent review, several preliminary conclusions were drawn by the Department in determining its preferred strategy for tritium supply which was announced by the Secretary on October 10.

On the basis of environmental considerations, the accelerator has an advantage because it does not use fissile material and thus no spent fuel is generated. In addition, the accelerator will generate less low-level waste than any of the other alternatives. Finally, while the risks of off-site accident consequences are very low for all alternatives, they are the lowest for the accelerator. On the other hand, because the large majority of commercial reactor candidates are already operating, the commercial reactor alternative has the fewest incremental environmental impacts of any alternative.

The ability to supply tritium when required is an obvious decisionmaking criterion. Judging this factor, the commercial reactors, the accelerator and advanced light-water reactors have a high probability of being available by 2011, even assuming technical or regulatory delays. A licensed gas-cooled or heavy water reactor would probably not be available by 2011, because changes in the current reactor regulatory structure would be required before licensing of either technology could take place. Should tritium be required closer to 2005 than 2011, the Department's assessment is that the existing commercial reactors and the accelerator have the highest probability of being available, given construction times and the potential regulatory delays for the new reactor technologies.

Cost considerations are, of course, a most important factor, especially at a time when deficit reduction is on everyone's mind. If one fact stands out as a result of both our own assessments and the Putnam, Hayes and Bartlett review, it is that there are large uncertainties in all of the cost estimates. Notwithstanding this uncertainty, two general conclusions can be drawn. First, the use of existing assets (commercial light water reactors) would almost certainly cost less than building a new facility. All of our analyses confirm this common-sense finding. Second, the range of projected life cycle costs for all new construction alternatives overlapped significantly. The Small ALWR appears to have the lowest likely cost range of all the new facilities. It, however, offers only modest advantages over existing reactors, which would almost certainly be less expensive. Thus, since there are large uncertainties in the cost projections, other factors I have described emerged as discriminators among the new supply facilities.

THE MULTIPURPOSE REACTOR

The option of using a reactor to "burn" excess plutonium, in addition to making tritium and generating electricity, has been carefully considered by the Department in terms of technical feasibility, environmental impact and cost. The issue of the potential range of costs for a government-owned multipurpose reactor compared to those for a privatized reactor was also considered, both by the Department and by Putnam, Hayes and Bartlett in their independent report.

The Department's analysis determined that it is technically feasible to produce tritium in a reactor which uses fuel fabricated from excess plutonium. This could be done in a light water reactor by using "mixed-oxide" fuel. Mixed-oxide fuel is fabricated from a combination of plutonium and uranium. Tritium could also be produced and plutonium "burned" in a gas-cooled reactor using fuel fabricated exclusively with plutonium, although there are greater technical uncertainties associated with the use of such a reactor. In order to make the required amount of tritium, a plutonium-fueled gas-cooled reactor facility would have to consist of twice as many reactors as a "tritium-only" facility using uranium fuel.

The Tritium Supply and Recycling PEIS addresses the incremental environmental impacts of adding the plutonium disposition mission to the primary mission of producing tritium for both the light-water and gas-cooled reactors. With regard to cost, much has been made of the potential benefits of construction and operation of a multipurpose reactor by a private consortium on a government site, using private sector funding. In such a scenario, the consortium would sell tritium target irradiation and plutonium disposition services to the Department. The Department examined both the feasibility of obtaining private funding for the construction of a new reactor and the potential difference in the cost of a government-owned vs. a privatized multipurpose reactor.

It is highly unlikely that investors would be willing to "foot the bill" for construction of a new reactor. Financing problems include the size of the investment, risks of completing construction, and general anxiety over nuclear projects that remains high in the investment community. Thus, the only private option which might be feasible for construction of such a project would rely on a combination of industry-based and debt financing. For more than 15 years, the commercial nuclear industry sought such investors without success, and has not found it economically or politically feasible to build new nuclear power plants in the United States.

Even if financing could be secured, the arrangement might not be the bargain for the government that some have claimed. In this regard, both the Department and Putnam, Hayes and Bartlett compared the potential costs of a government-owned and a privatized multipurpose reactor. It is clear that the government will be asked to bear most, if not all, of the financial risk of this venture through its payments for services. While the "up-front" cost to the government for a new reactor would clearly be less if constructed by a private consortium, both the Department's evaluation and the independent analysis concluded that the cost of money and the desire on the part of the private owners to make a return on their investment could well result in life-cycle costs to the government which are substantially more than if the reactor were government-owned.

It is important to emphasize that the preferred strategy for tritium production announced by the Secretary on October 10 preserves the option of combining the tritium and plutonium missions in an existing reactor. In that regard, the Department is now evaluating options for the disposition of plutonium in a separate PEIS. If the use of mixed oxide (MOX) fuel in light water reactors is chosen for the disposition of surplus weapons plutonium, it would take two large light water reactors, operating for approximately 15 years, with full MOX cores, to burn the amount of U.S. weapons plutonium currently declared as surplus. A decision on the most appropriate option or options for carrying out the plutonium disposition mission is expected late next year. Thus, the results of that analysis will be taken into account in determining the path forward for the tritium mission.

RATIONALE FOR A PREFERRED STRATEGY

The Department's rationale for developing a preferred strategy derives from the comparison of the alternatives. The first step of the approach was to review the alternatives to see if there was a clear winner (or winners) among the alternatives when compared upon the basis of cost, environmental impact, schedule, and technical assurance. Next, the Department looked for a way to provide some protection against the uncertainties inherent in the process of acquiring a new tritium supply.

This led to the dual track strategy that Secretary O'Leary announced last month. The dual track strategy not only provides a hedge against failure, but provides the greatest assurance of meeting a very aggressive schedule.

The first of the dual tracks is the investigation of the purchase of a commercial reactor or irradiation services. When one compares the reactor alternatives, the commercial reactor option has significant advantages over any of the new reactor candidates. It is the lowest cost option, has the least incremental environmental impacts, and has the potential to be implemented in the shortest period of time. The uncertainties associated with the use of a commercial reactor to make tritium are primarily related to concerns expressed by some about the use of commercial facilities for any military purpose. These concerns have been raised in the past in connection with the potential use of civilian facilities to make or reprocess special nuclear materials (plutonium and uranium). These concerns will have to be addressed should the decision be to pursue this alternative for acquiring a new tritium supply.

Key to the commercial reactor alternative is completion of the light water tritium target development program that was initiated several years ago but suspended in 1992. Completion of target development and qualification not only provides the Department with a viable long-term tritium supply option, but with a solid contingency source of tritium that could always be used in an emergency.

The second of the dual tracks, the accelerator alternative, has significant advantages over any new reactor candidate. It is a nonreactor technology that does not involve the use of fissile materials. Therefore it does not generate spent fuel and produces much less low level waste than the new reactor alternatives. Thus, it has the least environmental impacts of any of the other new technology candidates. It would not be subject to the potential regulatory issues and delays to which new reactor technologies are vulnerable. If tritium were to be required before 2011, no other new technology could likely be available earlier than the accelerator. In this regard, the Department's confidence in the viability of the accelerator for tritium production comes from exhaustive independent technical reviews by universities, laboratory groups, and other respected technical panels. This alternative would also utilize the scientific resources of our national laboratories, and contribute to the preservation of their core intellectual and technical capabilities.

I believe that the "dual-track" strategy we have identified is the best program for the nation. Within three years, the Department will have sufficient information on which to select one of these approaches as the primary tritium source and the other, if proven necessary and feasible, as a back-up. The Department's strategy would aggressively pursue two very promising, independent approaches, and would resolve uncertainties associated with each in a timeframe that will protect national security. This approach has the full support of the Nuclear Weapons Council.

DOE RESPONSE TO "GETTING ON WITH TRITIUM PRODUCTION": A REPORT TO SPEAKER NEWT GINGRICH

The primary recommendation of the report of the Speaker's Task Force on Tritium is that DOE should base its selection of a tritium production source on two objectives: maximizing the assurance that tritium sources will be available when needed and minimizing the cost to taxpayers. That is exactly what the Department of Energy is doing. We are committed to establishing a tritium production capability that meets stockpile requirements in a timely and cost efficient manner. Let me assure you, Mr. Chairman, that our motives are these alone and do not include the other motives imputed to the Department in the report.

The Department has been through an exhaustive process to reach its preferred strategy, including the preparation of the PEIS and a number of other reports. In identifying this strategy, DOE carefully reviewed all pertinent issues, including cost, schedule, technical, and environmental considerations. The process has included the public, other stakeholders, respected outside consultants, and Department of Defense experts. DOE reviewed and considered a wide variety of options for tritium production, including those identified by the Speaker's Task Force.

DOE is committed to completing the process it began in 1991. DOE has completed the final programmatic environmental impact statement for tritium production and anticipates issuing a record of decision later this month. We are prepared to immediately begin implementation of the decision reached at that time.

With all due respect, Mr. Chairman, we have considered all of the matters raised in the report and have reached the conclusions and preferences I described earlier based on a thorough and objective analysis.

SUMMARY

In summary, Mr. Chairman, the Department is committed to acquiring a new source of tritium for the national defense in a timely and cost effective manner, and is proceeding to do so. We believe that an objective look at the comprehensive analyses prepared by the Department and its independent consultants will lead to the conclusion that the preferred strategy we have identified makes good sense and should be implemented. I ask for your support, Mr. Chairman, and that of the entire Committee, in assisting us to fulfill our critical national security objectives.

Mr. SCHAEFER. The subcommittee thanks the gentleman for taking the time to come in today with his expertise.

I would first turn to the gentleman from New Jersey, Mr. Pallone, for whatever questions he might ask.

Mr. PALLONE. Thank you, Mr. Chairman.

And thank you for your testimony, Mr. Curtis.

One of the problems that I understand that sort of dogged the DOE's earlier tritium reactors was a lack of public confidence in their safety; and of course, I guess a lot of it had to do with their being built during wartime or whatever. But I guess I am assuming that consistent with Secretary O'Leary's policy of openness, the DOE would support outside safety regulation of any new tritium source; and I wanted to ask you whether the Department has a position on this.

In other words, if I could use an example, shouldn't any new tritium source be licensed before it goes into operation and be subject to safety regulation during its operating life?

Mr. CURTIS. Let me say that the Department is studying various aspects of submitting responsibility for facilities of the Department to external regulation. We expect that report to be available at the conclusion of this calendar year. So I do not want to prejudge the outcome of that report.

The Department has not made a policy judgment in answer to the question that you have posed, but let me make this comment. I think it is clear that it would be the policy of the Department that any new production source of tritium must achieve public confidence, both in its construction and its operation. If we are talking about a commercial light water reactor as a new production source of tritium that will sell electricity to the public, it unquestionably must be a licensed facility. If we are talking about an accelerator to meet the tritium requirements, there is not, at present, any licensing mechanism for accelerators.

The Department operates accelerators throughout the Nation. Accelerators are operated throughout the world. They are not subject to specialized licensing requirements. But again I would fall back to the point that we would obviously wish to assure the public of their safety. The important thing about accelerators, of course, is that they do not produce any spent fuel and much lower amounts of high-level waste than a reactor, and that changes the equation from the standpoint of a regulatory concern in a significant way.

Mr. PALLONE. Okay. I wanted to ask you about the relative environmental impacts of the two preferred options, and I read your written statement about that, but it was still unclear to me. Obviously, I am concerned about environmental impact and your testimony seems to suggest there is more than one way of looking at it.

On page 6 you point out that the linear accelerator offers the advantage of producing no spent fuel, less low-level waste and the lowest risk of an offsite accident; but then you go on to note that using an existing commercial reactor offers another advantage, because it has the, "fewest incremental environmental impact of any alternative." I am not sure I understand how these competing considerations are being weighed and which are—what you are really saying is better from an environmental impact standpoint.

Mr. CURTIS. Speaking only of the environmental impact, the point was made earlier that the accelerator is a large consumer of electricity. As such, it must acquire a power source. That power source undoubtedly will produce environmental impacts. It may be coal, it may be gas, it may be some combination of those.

So, from the standpoint of an accelerator's operation, it does not produce any spent fuel and much lower amounts of high-level waste, and its direct environmental impacts are considered low and quite manageable. But it will be a consumer of electricity, and there will be associated environmental impacts from that.

For an existing commercial light water reactor to produce tritium requires only that lithium containing target rods, which would be neutron absorbers, be substituted for control rods and or poison, which are also neutron absorbers, to produce tritium from irradiating lithium; and therefore, there is little net environmental impact with using an existing commercial light water reactor.

Even with this option there will be some environmental impact because we have to disassemble the rods and extract the tritium and then we would have some disposal problem, but it is minimal.

Mr. PALLONE. But in other words, you are just basically weighing the environmental consideration. How is that going to play into a final decision, ultimately?

Mr. CURTIS. Well, as Congressman Graham mentioned earlier, this is a complex question. What we are balancing here are cost and environmental considerations and the national security requirement, which requires flexibility to produce tritium by 2011 or later, or as early as 2005.

Some view it like a simultaneous equation. There is no dominant environmental issue or cost issue. The primary issue is meeting our national security requirement to support the nuclear deterrent.

Mr. PALLONE. Okay. I guess I am over time, but with the Chairman's, you know, giving me some extra time here, Mr. Ensign talked before about this—blurring this line between civilian and military uses, if you convert an existing commercial nuclear reactor. I didn't really understand—I mean, I understand that that is a concern, but could you address that briefly?

In other words, why is that distinction still important? Is it still important? And if so, why?

Mr. CURTIS. Well, I think the fair answer is, we don't know. The traditional distinction is that we not merge the military and commercial roles to produce weapons grade plutonium in civilian light water reactors, but, as has been pointed out, tritium is not a special nuclear material under the Atomic Energy Act, so it is distinguishable from that case. Whether this will prove to be politically acceptable and licensable to a civilian light water reactor remains to be demonstrated. For that reason, we are engaged, as part of this dual-path strategy over the next 2 years, in determining whether the institutional barriers can be overcome; to obtain expressions of interest, purchase options and demonstrate that the institutional barrier can be overcome. It must be overcome if you are to use a multipurpose reactor or an existing commercial light water reactor.

Mr. PALLONE. Do any other nations use the commercial reactors for tritium production?

Mr. CURTIS. Other nations produce tritium in reactors, the canon reactors in Canada, for example, but not for the purpose of producing tritium. Canada has a constitutional prohibition against tritium being used for military application.

Mr. PALLONE. But does that present a problem for our allies? Is that like a foreign relations issue basically in terms of——

Mr. CURTIS. Well, I think the fair answer is, it remains to be seen what the acceptability of this option will be both in international and domestic opinion. It is for that reason that we think a dual path is the appropriate approach to take, and it is also for that reason that when we talk about utilization of an existing commercial light water reactor, you will also hear us talk about either a purchase; or if we are buying irradiation services, an option to purchase. So that if an institutional barrier, once overcome, is at some later date re-erected, we could, in essence, take possession of the reactor, operate it solely for tritium production and, in essence, forgo electricity sales.

Mr. PALLONE. Okay. Thank you, Mr. Chairman.

Mr. SCHAEFER. The Chair thanks the gentleman.

The gentleman from Georgia, Mr. Norwood.

Mr. NORWOOD. Mr. Chairman, I would like to pass until we vote, if that is all right with you.

Mr. SCHAEFER. Mr. Deal is—the gentleman is—how about the gentleman from Massachusetts? Are you going to go over and vote, or are you going to come back? You probably don't have any questions.

Mr. MARKEY. Well——

Mr. CURTIS. I thank the Chairman for that.

Mr. MARKEY. I mean, these guys, they hustled in here with this camera. Who are you preparing?

The CAMERAMAN ONE. Aurora.

Mr. MARKEY. Aurora, who are they?

The CAMERAMAN TWO. Southern Nuclear.

Mr. MARKEY. You might as well give them—they paid a lot of money for this film. You might as well give them some questions.

Mr. SCHAEFER. I turn to the gentleman.

Mr. MARKEY. So let's look at the three options for a second if we could. Commercial, triple-play and accelerator, are those basically the three choices you have?

Mr. CURTIS. I would state it differently. We have a reactor option and we have an accelerator option.

Mr. MARKEY. Where do you put the triple-play?

Mr. CURTIS. It is a reactor option.

Mr. MARKEY. A reactor. But you have a commercial reactor and then you have the triple-play reactor. Is there a third reactor category?

Mr. CURTIS. Yes. Let me try.

The real difference here is whether you build a new reactor or whether you use an existing commercial reactor. You can—if you make the policy judgment to do so, do the plutonium disposition mission in either an existing commercial light water reactor or in a new reactor; so if it is the policy judgment to dispose of plutonium by irradiating it in a reactor, as distinguished from vitrifying it in glass logs for disposal, that is not incompatible in the administration's judgment with preferred options for tritium production. That could still happen.

Mr. MARKEY. Right. But that also involves the permanent long-term disposal questions as well.

Mr. CURTIS. Yes, that is correct. And that is a policy judgment yet to be made, but which will be made in calendar year 1996.

Mr. MARKEY. Those questions are still unanswered as well, although, as you know, I have a bias that all of this stuff should be buried permanently wherever the proper geologic location may be.

What bothers me most is that this Congress thinks it can pick Yucca Mountain and say that will be the proper site for all permanent storage and hedging their bet with interim, and then they want to pick this technology as well. And while I do believe that there is such a thing as a congressional expert, I also stipulate that it is an oxymoron and that it is only—we are only experts compared to ourselves, not compared to real experts, and that when we start to substitute our scientific judgments, technology judgments for those of real experts, we are into an extremely dangerous territory, not only scientifically, but also for the taxpayer.

The commercial option on the chart that I have been given, but that was prepared by the firm of Putnam, Hayes and Bartlett, DOE Tritium Production Options, has a $4.5 billion price tag for a light water reactor, then up to $10.1; $4.5 to $6.8 for light water; $10.1 to $12.5 for a triple-play; and $14.8 for an accelerator. It is on page 6 of the report.

And what I would like you to do, if you could, is just to analyze these costs so that we can make prudent budgetary judgments as to how we get the job done without breaking the bank.

Mr. CURTIS. If I may, Mr. Markey, let me just make a preliminary comment because there is some confusion in the record on this matter.

Putnam, Hayes and Bartlett is a well-known, well-regarded consulting firm. What they were asked to do is to review the cost estimates that the Department had prepared in conjunction with its analysis of the options, and they have provided, in essence, judgments and sensitivity analyses with respect to those costs; but it would not be correct to believe that they have done a fully independent cost analysis.

Mr. MARKEY. I see.

Mr. CURTIS. I am sure they would wish me to say that.

With respect, nevertheless, to those data that you have addressed, as each of the Members' comments have revealed, there is a considerable degree of uncertainty between the lowest cost estimate and the highest cost estimate of each of the options. It is that range of uncertainty that the Department is evaluating in arriving at its Record Of Decision, which should be concluded by the end of November.

Mr. MARKEY. I won't pursue this then. Okay, thank you. The Department has expressed support for ending subsidies for regional power marketing administrations, has it not?

Mr. CURTIS. Yes.

Mr. MARKEY. Would this kind of a subsidy be inconsistent with the larger policy objectives which the administration has for the regional power administrations? That is the triple-play option.

Mr. CURTIS. If the Chairman will indulge me, this question invites clarifying the record in a number of respects, if I could.

Mr. SCHAEFER. Go ahead.

Mr. CURTIS. First of all, the Department spent a great deal of money over the last 3 years evaluating the triple-play option. It is not a correct conclusion that the Department has ignored the triple-play reactor. Indeed, it has been directed by the Congress through earmarked funds in three fiscal years to examine the triple-play, and we have.

Second, I think it is also inappropriate to conclude that in our dual-path forecasted spending that we are spending only $5 million to explore the commercial light water reactor path and a significant more to do the proof of concept work on the accelerator, that that represents a bias. The reality is, it is simply not that costly to explore the options for commercial light water reactors because you are not building or designing a large facility but rather exploring interest and the regulatory issues associated with the institutional barrier.

Third, with respect to the multipurpose reactor, the proposal that has been presented contemplates that the Department will provide both a tipping fee, as described by Congressman Graham, for the plutonium disposition and a long-term contract for the tritium services. It is those two long-term contracts that would be relied on for financing.

So this is not a free option. This would obligate the Federal Government.

Mr. MARKEY. Excuse me just 1 second, if I may.

Mr. SCHAEFER. We are checking to see how much time we have on the vote. I am trying to indulge Mr. Curtis so we don't delay him any longer than possible, but—2 minutes.

Mr. MARKEY. Two minutes on the rule?

Mr. SCHAEFER. I am going to have to recess just briefly. Mr. Curtis, I apologize.

Mr. Deal is coming back, and he will begin. If the gentleman should wish, he can have more time. We will be recessed just shortly.

[Brief recess.]

Mr. DEAL [presiding]. We will reconvene the hearing. We will consider anybody else who is not here as nonessential anyway.

The Chair will recognize the gentleman from Georgia, Mr. Norwood.

Mr. NORWOOD. I thank the gentleman from Georgia. I am curious whose camera that was, Mr. Chairman. Does anybody know?

SPECTATOR. Southern Company.

Mr. NORWOOD. Southern Company? Very good. That is perfectly fine.

Mr. DEAL. It is perfectly fine with the Chair, too.

Mr. NORWOOD. Gentlemen, we appreciate you and the work that you do, and I appreciate your testimony, and I will never get through all of my questions.

Mr. Chairman, with your permission, I will submit the questions to DOE.

I do have one request. The last time we submitted questions to DOE, it took 4½ months. The best I can figure, there are 536 of us up here and we ought not to take that long to get answers; and if we could get them a little faster, I would appreciate it very much.

Dr. Reis, I know of the good work you do and have done. I am curious to know a little bit who you work for. Who is your immediate boss?

Mr. REIS. It is the gentleman on my left, Mr. Curtis.

Mr. NORWOOD. And Mr. Curtis, to the Secretary?

Mr. CURTIS. Yes, sir.

Mr. NORWOOD. And the Secretary, to the President?

Mr. CURTIS. That is right.

Mr. NORWOOD. The question then is, do you have a clue how the President feels about reactors, nuclear reactors?

Mr. CURTIS. No, sir.

Mr. NORWOOD. He has never implied anywhere he feels one way or the other?

Mr. CURTIS. I believe in the President's campaign, he identified nuclear power as a last-resort option for power supply.

Mr. NORWOOD. He has never come to you and——

Mr. CURTIS. But never, so far as I am aware, has he expressed any opinion on the use of reactors for tritium production.

Mr. NORWOOD. Well, I don't mean just tritium. I mean nuclear reactors in general. He has never come to the Secretary or, therefore, to you, saying, there will never be a nuclear reactor built on my watch?

Mr. CURTIS. No, sir.

Mr. NORWOOD. That is very good.

Mr. CURTIS. Could I make a point on that, please?

Mr. NORWOOD. Sure.

Mr. CURTIS. Because there is a concern about this so-called antinuclear bias in the Department.

Mr. NORWOOD. Right.

Mr. CURTIS. I just want to point out that we in these difficult fiscal times have carried in the budgets for the the last 3 years some $40 to $60 million a year in continued investment in advanced light water reactor designs. I think that indicates a continuing and sustaining commitment to preserving the nuclear option as a power supply choice.

Mr. NORWOOD. Well, we are pleased. There just seems to be a bias, according to many of the reports that we have read, and I guess one way to get Mr. Markey back to this hearing is to indicate he is probably the only one then on this panel that is antinuclear.

My question, Mr. Curtis, is complex—all of these are, and short answers if possible. In your testimony, you mentioned a summary report called a Technical Reference Report for Tritium Supply and Recycling. Can you tell me, when was this technical reference report issued?

Mr. CURTIS. On October 20. I have it here, Mr. Norwood, and it has been available in our public reading room since that date.

Mr. NORWOOD. Is there a reason that this document was not referenced in the environmental impact statement?

Mr. CURTIS. Cost considerations are a matter of prudent judgment but not an integral part of the environmental assessment, which is what the Environmental Impact Statement is required to address; and therefore, it is typical that you produce cost information as a supplement to the Environmental Impact Statement. It is a supporting supplement.

Mr. NORWOOD. What—which department or which office basically was responsible for the document?

Mr. CURTIS. Defense Programs, the office that Dr. Reis heads.

Mr. NORWOOD. Mr. Chairman, I would like to have this document submitted as part of the record. If, in fact, this document contains three out of four subjects of the Department's decision process, it must be very important to us and—I mean, the cost schedule and technical analysis.

And could you tell me just offhand how much this study cost us?

Mr. CURTIS. I could not, but I would be happy to supply that for the record.

Mr. NORWOOD. Thank you.

[The information referred to follows:]

The detailed cost, schedule and technical analyses conducted by the architect-engineering contractor under the direction of the Department are summarized in the Technical Reference Report, which was issued on October 27, 1995. The studies that are referenced in the Technical Reference Report, and the preparation of the Report itself, cost approximately $10 million.

Mr. NORWOOD. In your testimony, you declare the accelerator has advantages because it does use fissile material, it doesn't generate spent fuel and it generates low quantities of low-level waste. Talk—tell me—just a minute for this panel about the electricity requirements for an accelerator.

Mr. CURTIS. Mr. Norwood, you may have missed my earlier remark to Congressman Markey that it is perfectly valid to point out that the accelerator requires a great deal of electricity to operate. Of course, it depends upon how much it must produce and the hours of operation. But the power requirement is—I think on the order of 300 megawatts and there are cost-associated environmental impacts in producing 300 megawatts of power.

Mr. NORWOOD. That is where I am going.

How do you obtain—how do you envision obtaining the electricity needed for the accelerator? Would it be a nuclear power plant, or a gas or coal power plant, or some other means?

Mr. CURTIS. Let's assume for a moment that the accelerator is built. Our preferred option is that it be sited at the Savannah River Site. The accelerator's power requirement is a little less than 5 percent of the grid's requirements in the Southeast Power Region. It would have to be obviously acquired from generating sources in the region at that time.

Mr. NORWOOD. And that could probably be, then, nuclear power?

Mr. CURTIS. It would.

Mr. NORWOOD. It is very close by and available?

Mr. CURTIS. Whatever the power mix is, yes, sir. Vogtle is close by and available. Vogtle is run on a must-run basis, and therefore, you could argue that nuclear power is contributing to the source of power for the accelerator because it would be a base-load requirement.

Mr. NORWOOD. Was any of this environmental information included in the impact statement?

Mr. CURTIS. I believe that was, in fact, looked at, yes, sir.

Mr. NORWOOD. Based just on nuclear?

Mr. CURTIS. No, not based on nuclear, but based upon evaluations of the power available in each of the five site regions that were under analysis, of which Savannah River was one.

Mr. NORWOOD. Is the advance test reactor in Idaho a light water reactor?

Mr. CURTIS. Yes.

Mr. NORWOOD. Have you produced tritium in this reactor?

Mr. CURTIS. I don't know. We could produce tritium in that reactor. We may have, on a test basis, but certainly not on a production basis.

I believe there has been some target rod development, as you know, that the department engaged in before the Congress ruled it out, and it may have been tested at that reactor. That would be a logical place to test it.

Mr. NORWOOD. Knowing we have a number of accelerators, tell me this, is tritium being produced in any of DOE's accelerators?

Mr. CURTIS. Not that I know. I would be happy to supplement for the record. But let me say that tritium has not been produced for the purpose of contributing to the strategic reserve for tritium at any of those sources.

[The information follows:]

Two experiments to produce tritium have been conducted at the Los Alamos National Laboratory using the 800 MeV proton accelerator (LANSCE). In both experiments an 800 MeV proton beam impinging on a tungsten spallation target produced neutrons that were then slowed down (moderated) and captured in 3-Helium to produce a very small quantity (a fraction of a gram) of tritium. These experiments were conducted to demonstrate the process proposed for tritium production in an accelerator.

Mr. NORWOOD. I understand.

Mr. CURTIS. But we may have done test operations in either of those sources.

Mr. NORWOOD. A test to just——

Mr. CURTIS. I will have to submit that for the record. I know we have tested the light water targets, and I just don't know the circumstances associated with the accelerator. We will supply it for the record.

Mr. NORWOOD. It is my understanding that in deciding a tritium production option, DOE would take into account analysis of environmental costs, schedules and technical information. Now I understand that a final tritium supply and recycling environmental impact statement has been issued.

Do you consider this document to fulfill the environmental analysis portion of this decisionmaking process?

Mr. CURTIS. Technically, it still requires a Record Of Decision that must be issued no earlier than 30 days after the final EIS was published. When that is done, it will conclude the process and we believe it to be legally sufficient for environmental purposes.

Mr. NORWOOD. You think, yes, and you expect a decision when, I am sorry?

Mr. CURTIS. At the end of this month.

Mr. NORWOOD. What has this little thing cost us?

Mr. CURTIS. I don't know. Again, I would be happy to give an estimate for the process but it is not yet concluded. I will give an estimate for the record.

[The information referred to follows:]

DOE estimates the cost for the Tritium Supply and Recycling PEIS to be between $19-20 million. This includes the cost of the preparation of the environmental analyses and the preparation of the technical description of alternatives and provision of environmental data for the five candidate sites by Fluor Daniel, Inc., the architect-engineering contractor.

Mr. NORWOOD. Any—do you want to give us estimated costs now for these guys?

Mr. CURTIS. Well, I think it is a lot. For one thing, the Department had under way a new production reactor analysis that was very costly, and we have used some of the information developed from the new production reactor project for this EIS, but these things are very, very costly.

Let me make this point, though. The history of NEPA implementation and ensuing litigation on matters of controversy suggest that you be very, very careful in your environmental impact statement analysis, particularly when you are dealing with a matter of importance to national security, because we cannot tolerate having to go back and do this thing again.

Mr. NORWOOD. No ballpark?

Mr. CURTIS. I really don't know.

Mr. NORWOOD. Anybody?

One last question, Mr. Chairman?

Mr. DEAL. The gentleman may proceed.

Mr. NORWOOD. I like the Chairman being from Georgia.

DOE commissioned a cost study on tritium production to the Putnam, Hayes and Bartlett firm. How much did this study cost us?

Mr. CURTIS. I don't know, but I would be happy to supply that for the record.

Mr. NORWOOD. Would you consider that this is to fulfill the cost-gathering portion of the decisionmaking process?

Mr. CURTIS. We expect, when the Record Of Decision is issued, that it will take into consideration the adequate consideration of the associated cost, yes.

Mr. NORWOOD. Is this the only cost data that you utilize, or how about an independent cost?

Mr. CURTIS. Well, there are comments that have been submitted subsequent to the publication of the Technical Reference Report, and it is within our latitude to take those into consideration before a Record Of Decision is issued. So I don't want to exclude that universe of comment.

ABB, for example, has made comments on aspects of the cost analysis; and I don't want to suggest that we will not consider those comments before we issue a Record Of Decision.

Mr. NORWOOD. Mr. Chairman.

Mr. CURTIS. Indeed, we intend to.

Mr. NORWOOD. I know my time is up, and I want to thank you all, gentlemen. We are all on the same side, and I do have a lot more questions, and I truly—I meant earlier it ought not to take 4½ months. I mean, how many employees at DOE?

Mr. CURTIS. Less every day, Mr. Norwood.

Mr. NORWOOD. I understand that. I know that as well as you do.

Mr. CURTIS. I can make an absolute commitment to you, I will return answers within 2 weeks. You will have them when a Record Of Decision is issued.

Mr. NORWOOD. That is absolutely fair, Mr. Curtis.

Thank you, Mr. Chairman.

Mr. SCHAEFER. I would say, Mr. Norwood, without objection, any member of the committee will be submitting questions you don't have the numbers for right now, Mr. Curtis, for written answers.

[The information referred to follows:]

The Putnam, Hayes and Bartlett (PHB) report cost approximately $750,000.

Mr. SCHAEFER. We recognize the other gentleman from Georgia, Mr. Deal.

Mr. DEAL. Thank you, Mr. Chairman.

It is my understanding that not more than 6 years ago DOE spent several hundred millions of dollars planning dual reactor strategy for tritium production utilizing a new heavy water reactor and a gas cool reactor.

Has DOE taken this previous investment into consideration in its latest assessment of tritium production needs, and what has changed since that time to challenge the validity of the DOE's past approach?

Mr. CURTIS. Yes, your reference is to the work that was done on the New Production Reactor Program, and we have, in fact, used that work in the context of this environmental impact statement analysis. What has changed are two things of importance.

First, the New Production Reactor Program contemplated a much larger requirement for tritium than we are looking at today in the wake of the arms reduction agreements. Second, the accelerator was not an option at that time because the technology had not been developed. Also, the change in requirement has brought the accelerator within the scope of possible options.

That is the fundamental difference between those circumstances and today's circumstances.

Mr. DEAL. So you are saying, the diminished demand for tritium has made the accelerator option more viable?

Mr. CURTIS. It has—yes, sir, it has brought it within range. It would not be within range at the full new production reactor capacity requirement.

Mr. DEAL. One of the benefits of utilizing a reactor for tritium production would be the benefit of revenues gained from the power generation. Has DOE examined the need for new power generation at the sites that are proposed for the new reactor construction?

Mr. CURTIS. The availability of power in each of the regions was examined. I can't tell you whether we have examined it from the standpoint of its making a contribution to that power requirement. We have examined it from the standpoint of the availability of power. An option that produces its own power, of course, would be taken into consideration.

Mr. DEAL. With that be factored into any final decisions?

Mr. CURTIS. It certainly would. Obviously, one of our paths, looking at the existing commercial light water reactor would contemplate that the reactor would remain in the electric power grid and, as a consequence, the cost to the Federal Government of acquiring irradiation services should be materially reduced.

If we had to take that reactor out of electric service, those costs, correspondingly, would be much greater.

Mr. DEAL. I have one last question, Mr. Chairman, if that is satisfactory.

One of the witnesses on our next panel will dispute the accuracy of the PHB study in assessing the cost of various tritium production options—that the study assumes that DOE would receive free irradiation services from commercial utilities, that the estimated cost of purchasing an existing reactor is understated, and that the cost of constructing a new reactor is overstated, to name a few.

Would you care to respond to the assertion that the PHB study is fatally flawed in its assumptions?

Mr. CURTIS. I am aware only recently of that assertion.

Let me say that I would welcome the sponsor of those comments submitting a detailed statement of their assumptions and study methodologies, so that we might have the opportunity to evaluate their analysis; and if it is done in a timely manner, we will evaluate that analysis before our Record Of Decision is issued. But we are now within the last 2 weeks of that process. So I would welcome them doing that. If so, we will take it into consideration.

Mr. DEAL. Thank you, Mr. Chairman.

Mr. SCHAEFER. The Chair thanks the gentleman.

Mr. Curtis, several of our witnesses, including yourself, referenced the fact that DOE has not yet completed its work on lithium target development. What is the current status of this program? When does DOE plan to complete the development? And when would the targets be available for reactor use?

Mr. CURTIS. Let me give you a little history to that, if I might.

Target development was initiated in the context of the New Production Reactor effort. A number of targets were made. They are not of commercial reactor size. They are of a short length, because they were developed, in essence, to test the technology, not as a production target rod.

In the appropriations bill of fiscal year 1992, the Congress directed us, in joint statement of manager's language, to terminate that program. We have, in our 1996 budget, which I am happy to report the President signed the night before last, money to resume that target development work. We intend to carry that program to full operation, which would involve not only the development of the targets, but modification of the extraction facility at the Savannah River Site. We are going to do that because we need to do this as a contingency, in any case, so that we have a backup to the new production source for tritium in the event we were, by act of God or other circumstance, to lose it.

So that total program is about a $100 million program, I believe, and it is accomplishable. It really depends on how quickly you need to do it, but it is accomplishable as early as 2003.

Mr. SCHAEFER. And the current status? Are you on line with your——

Mr. CURTIS. We intend to keep it under way, and it will be a part of our budget submission in 1997, and it will continue through the ensuing years.

Mr. SCHAEFER. What, if any, safety considerations are there surrounding the lithium targets in a commercial reactor?

Mr. CURTIS. I don't know of any technical concern nor any particular safety concern with the use of these targets in a commercial light water reactor.

Mr. SCHAEFER. Has the NRC been involved in either an advisory capacity or a design capacity with DOE's lithium target program?

Mr. CURTIS. We have certainly had discussions with the NRC staff concerning this program and our intentions, and have explored issues of licensing and also technical issues. I want to underscore the word "staff." We have not had any discussions with the Commission itself.

Mr. SCHAEFER. And they haven't any problems at this point in time?

Mr. CURTIS. I think it is safe to say we have identified no showstoppers. There are still questions.

Mr. SCHAEFER. Do you foresee that the possible use of these lithium targets would trigger any further NRC licensing—amendments for operating this thing? Are we looking at having to further amend these licenses?

Mr. CURTIS. There are two schools of legal opinion as to whether a license amendment would be required or not. We would almost certainly require a license amendment, just to have the full confidence that it would not be in legal jeopardy. The national security would depend upon mission continuity.

Mr. SCHAEFER. I have one other question.

Does DOE have any concerns about the remaining life expectancy of an existing reactor should the purchase option be utilized? If so, what special liability concerns would accompany the purchase of a used commercial reactor?

Mr. CURTIS. Let me take the latter first, and then I will come to the purchase. If we were to purchase the reactor, obviously the government would assume the liability responsibilities of its continuing operation, except, by contract. If the government were to contract that responsibility to an M&O contractor, there may be some division of responsibility provided for in the contract. And, if the government were to own the facility, it would be assuming a large portion of the decommissioning and decontamination costs, but presumably that again would be a negotiable item between the selling utility and the government.

Mr. SCHAEFER. So, in other words, you would treat it similar to a contractor being used to clean up Rocky Flats. There would be joint responsibility and this type of thing?

Mr. CURTIS. Yes, I think it is fair to say that we would both distribute the liability and the cost responsibility for decommissioning and decontamination by contract.

Now, you will have to remind me of the first part of your question. I am sorry.

Mr. SCHAEFER. Well, the life expectancy.

Mr. CURTIS. There are a large number of reactors that have license lives that will expire in the 2025-to–2030 region. You will hear from a witness today that with respect to the Vogtle plants, their two units, their license lives are, I believe, 2027 and 2029; and both plants would presumably have life-extension opportunities that could permit up to an additional 20 years of operations.

Is it a concern? It is a matter of consideration, because obviously we are talking about having confidence in our ability to provide a tritium supply in the future, and if we do not have full confidence in life extension, then we have to presume that that option is 2027–2029 limited.

Mr. SCHAEFER. I have no further questions.

Either of the gentlemen from Georgia?

Well, Mr. Curtis—we thank you very much for being here, gentlemen, and giving us insight into this; and we will be submitting some questions. We appreciate it.

[The questions and responses follow:]

QUESTIONS FROM HON. CHARLIE NORWOOD AND RESPONSES

Question 1: It is my understanding that in deciding a tritium production option, DOE would take into account analyses of environmental, cost schedule, and technical information. I understand that a Final Tritium Supply and Recycling Environmental Impact Statement has been issued.

Do you consider this document to fulfill the environmental analysis portion of this decision-making process? When do you expect to issue a record of decision?

Response: The Tritium Supply and Recycling Final Programmatic Environmental Impact Statement (PEIS) was distributed on October 20, 1995, with a Notice of Availability by the Environmental Protection Agency issued on October 27, 1995. The PEIS contains the environmental analyses sufficient to make programmatic decisions regarding a new tritium supply source. The Department will prepare project-specific environmental documentation prior to designating (1) a specific footprint on the Savannah River Site for construction of an accelerator, if one is built, or (2) a specific reactor(s) and site if a commercial reactor is selected for the long-term tritium supply mission. The Record of Decision for the PEIS will be issued shortly.

Question 2: How much (approximately) has the Final Tritium Supply And Recycling Environmental Impact Statement cost thusfar?

Response: DOE estimates the cost for the Tritium Supply and Recycling PEIS to be between $19-20 million. This includes the cost of the preparation of the environmental analyses and the preparation of the technical description of alternatives and provision of environmental data for the five candidate sites by Fluor Daniel, Inc., the architect-engineering contractor.

Question 3: DOE commissioned a cost study on tritium production options to the Putnam, Hayes & Bartlett firm.

How much did this study cost (approximately)? Do you consider this to fulfill the cost-gathering portion of the decision-making process? Is this the only cost data that DOE will utilize? Is it an independent cost study?

Response: The Putnam, Hayes and Bartlett (PHB) report cost approximately $750,000. PHB did not prepare an independent cost estimate. Rather, the firm independently reviewed the base cost estimates that had been prepared by the Department and arrived at ranges of potential costs for the various alternatives by varying assumptions regarding, among other things, construction costs, electricity prices/revenues, fuel cycle costs, costs of target and processing facilities, purchase price of a reactor and cost of life extension (for the reactor purchase option), and number of reactors used (for the irradiation services option). The PHB report is not the only cost report utilized by the Department in its decisionmaking. The Department assessed the uncertainties associated with the base cost estimates prepared under its direction by the architect-engineering contractor, and ranges of potential costs were identified with low, median and high values identified in the Technical Reference Report issued on October 27, 1995. The PHB input was used by the Department in arriving at the final cost ranges reported in the Technical Reference Report. For the multipurpose reactor option, both the Department and PHB developed a range of potential costs, as described in the Technical Reference Report.

It is important to emphasize that the Department will continue to study the costs of the alternatives that will be pursued after the Record of Decision is issued. As development work on the technologies goes forward, the Department will gain a better understanding of the economics of these alternatives and will be in a better position to select a primary tritium supply source for the future.

Question 4: Has a detailed schedule analysis been performed? Have technical analyses of the tritium production options been performed? Who within the Department is responsible for objectively reviewing all of the environmental, cost, schedule, and technical analyses for each tritium producing option?

Response: The architect-engineering contractor was tasked to develop detailed cost, schedule, and technical analyses for each of the supply technologies and the recycling alternatives. These analyses were prepared under the direction of the Office of Reconfiguration, within the Department's Office of Defense Programs, and are summarized in a number of reports listed in the Technical Preference Report issued on October 27, 1995. In addition, an uncertainty analysis was completed which involved experts from DOE, its laboratories, and contractors. The data and uncertainty analysis was reviewed by the Office of Reconfiguration. Environmental analysis was prepared by the environmental contractor under the direction of the Office of Reconfiguration. It was reviewed by the Office of Reconfiguration, DOE field offices and their contractors.

Question 5: In your written overview, you mention a summary report called a Technical Reference Report for Tritium Supply and Recycling.

When was the Technical Reference Report for Tritium Supply and Recycling issued? Why is this document not referenced in the Environmental Impact Statement? What office in the Department of Energy was responsible for this document? Was this document issued after the preferred alternative was announced? If so, how can a preferred alternative be selected without the benefit of this information? I would like this document to be submitted as part of the record. How much did this study cost (approximately)?

Response: The detailed cost, schedule and technical analyses conducted by the architect-engineering contractor under the direction of the Department are summarized in the Technical Reference Report, which was issued on October 27, 1995. This Report has since been distributed to the Congress and the entire Tritium Supply and Recycling mailing list. The Office of Reconfiguration was responsible for the production of this document. While the preferred alternative was announced prior to issuance of the Final PEIS and the Technical Reference Report, the information reflected in these documents was used by the Secretary in identifying the dual track approach which she announced as the Department's preferred strategy on October 10, 1995.

The studies that are referenced in the Technical Reference Report, and the preparation of the Report itself, cost approximately $10 million. I have included an additional copy of the Technical Reference Report to be included in the hearing record.

Question 6: In your written overview, you declare the accelerator has advantages because it does (sic) not use fissile material, it doesn't generate spent fuel, and it generates lower quantities of low-level waste.

What are the electricity requirements for the accelerator (approximate)? How do you envision obtaining electricity for the accelerator—a nuclear power plant, a gas or coal power plant, or some other means? Has this impact been taken into consideration in the Environmental Impact Statement?

Response: The accelerator would require approximately 550 MWe to produce 3/8th (maximum) tritium quantities, and approximately 355 MWe to produce the 3/16th (steady-state) tritium quantities. Electricity would be provided to the accelerator by either: (1) purchase from regional power pool grids; or (2) building and operating a dedicated power plant. The environmental impacts of each of these means was assessed in the Tritium Supply and Recycling PEIS, but no decision has been made at this juncture regarding the method of supplying power to the accelerator. If an accelerator were to be built, the site-specific environmental impact statement would fully explore the options for providing power to the accelerator, and the source of power would be determined at that time.

Question 7: In your written overview, you assume regulatory licensing for all reactor types, but not for the accelerator.

Has this been decided?

Response: It is not certain whether the Department's nuclear facilities, including a new tritium supply facility, would be subject to external licensing. However, the Department's Task Force on External Regulation is scheduled to present by the end of this calendar year its recommendations regarding whether and by whom external regulation of Department facilities should take place. Existing commercial reactors are now licensed and regulated by the Nuclear Regulatory Commission (NRC). The Department assumes that an existing facility used to make tritium for the Department would remain licensed by the NRC. While issues such as license transfer and license amendments for insertion of tritium target rods would need to be addressed, these issues are not nearly as complex as initial reactor licensing would be, and there is high confidence that regulatory issues associated with the purchase of an existing reactor or purchase of irradiation services can be resolved in a timeframe that will allow the Department to have new tritium available when required.

In discussing regulatory delays, the NRC regulatory structure and process was used to represent the kind of regulatory process that might be applicable to new reactor candidates. For the accelerator, it is likely that an external organization, such as the Defense Nuclear Facilities Safety Board, would review at least portions of the accelerator design. In particular, the target/blanket and tritium processing systems will contain sufficient radioactive material (tritium and activation products) to be classified as non-reactor, nuclear facilities under the Department's current Orders. However, the review of these accelerator systems would not involve anything approaching the complexity of a nuclear reactor safety review, and thus would not be subject to the potential regulatory delays associated with reactor licensing.

Question 8: Is the Advanced Test Reactor in Idaho a light water reactor? Have you produced tritium in this reactor? What quantities have been produced (kilograms, grams, or curies)?

Response: The Advanced Test Reactor, a unique design, does use light water as a coolant and moderator.

Tritium has been produced in the Advanced Test Reactor for research and development purposes. This has been done on two occasions:

(1) In 1990-1991, a small number of light water reactor prototype target rods were irradiated in the Advanced Test Reactor under the former New Production Reactor Program. Because the entire light water target project was stopped at the end of FY 1992, only one target underwent post-irradiation examination. The remaining targets are in storage in Idaho pending renewal of work. These rods are estimated to have produced slightly more than a gram of tritium.

(2) Sixty-four targets, specially designed for use in the Advanced Test Reactor, were irradiated from August 1994 to January 1995, as part of a study of the feasibility of using the reactor as a supplemental source of tritium. A total of three grams of tritium was produced. Using available capacity, the Advanced Test Reactor could make 300 grams of tritium per year.

Question 9: Has tritium ever been produced at any of DOEs accelerators? What quantities have been produced (kilograms, grams, or curies)?

Response: Two experiments to produce tritium have been conducted at the Los Alamos National Laboratory using the 800 MeV proton accelerator (LANSCE). In both experiments an 800 MeV proton beam impinging on a tungsten spallation target produced neutrons that were then slowed down (moderated) and captured in 3-Helium to produce a very small quantity (a fraction of a gram) of tritium. These experiments were conducted to demonstrate the process proposed for tritium production in an accelerator.

Tritium is produced incidentally, but routinely, at many accelerator facilities. This tritium is produced by neutron activation of the water in the cooling systems at the high energy end of the accelerator. The total quantity of tritium produced in this manner has been a few grams.

Mr. SCHAEFER. The Chair now calls up panel No. 2, Mr. Paul Lisowski, Project Director, Accelerator Production of Tritium at the Los Alamos National Laboratory; Christopher Paine, Senior Research Associate, Natural Resources Defense Council; George Davis, ABB Combustion Engineering Services; and James Miller, Southern Nuclear Operating Company. Therefore, at about 10 minutes into the next vote, we are going to have to recess and run over and do our voting, then get back. So if you will indulge us on that, I just want to let you know ahead of time.

STATEMENTS OF PAUL W. LISOWSKI, PROJECT LEADER, ACCELERATOR PRODUCTION OF TRITIUM, LOS ALAMOS NATIONAL LABORATORY; CHRISTOPHER E. PAINE, SENIOR RESEARCH ASSOCIATE, NATIONAL RESOURCES DEFENSE COUNCIL; GEORGE DAVIS, PROJECT MANAGER, SYSTEM 80-PLUS DEPLOYMENT, U.S., ABB COMBUSTION ENGINEERING NUCLEAR SYSTEMS; AND JAMES H. MILLER, III, SENIOR VICE PRESIDENT AND CORPORATE COUNSEL, SOUTHERN NUCLEAR OPERATING COMPANY, ACCOMPANIED BY FRED WILLIAMS, SENIOR VICE PRESIDENT, GEORGIA POWER COMPANY

Mr. SCHAEFER. Mr. Lisowski, do you wish to lead off?

Mr. LISOWSKI. I would like to, yes, sir.

Thank you, Mr. Chairman and members of the subcommittee. I am indeed pleased to have this opportunity to address the committee on the important national security issue of providing an assured source of tritium for our nuclear stockpile. I have written testimony that I would like to submit for the record.

Mr. SCHAEFER. Without objection, the full testimony of all the Members of the panel will be part of the record, and you may summarize as you wish.

Mr. LISOWSKI. Thank you. I will summarize the main points of that testimony in what I am about to say.

The announcement by the Secretary of Energy on October 10th, 1995, to pursue a dual-track strategy has set in motion plans that will assure tritium production for the United States nuclear stockpile through either reactor or accelerator technology. Throughout my testimony, I plan to refer to accelerator technology as APT.

We at Los Alamos National Laboratory—and let me remind you that we have been in the business before, supporting the stockpile for 50 years—agree with the Department's strategy and are convinced that the unique advantages of the accelerator approach will lead the DOE to a decision to construct an APT plant at Savannah River.

Presently, there are only two practical systems that can make enough neutrons to produce tritium. Those are reactors and accelerators. In a reactor, nuclear fission supplies the neutrons. In APT, neutrons are made by a process known as spallation, in which energetic protons from a linear accelerator interact with a heavy metal target, such as tungston, to make the neutrons. It is this difference in how the neutrons are produced that results in the many unique advantages for the APT system.

The APT plant will have two major parts: a proton linear accelerator and a tritium production and extraction facility.

I would like to answer at this point, Mr. Norwood's question about the cost. The design study that has been conducted over the past 3 years has cost the government approximately $40 million. This can be compared to about $1 billion that was spent earlier on the reactor—new production reactor program up until the year 1988.

The APT system that we are discussing this morning has been subjected to several in-depth examinations over the past 12 months. Those examinations looked at technical reports which were provided to the Department, only a small amount of which I bring here to share with you.

In addition to review by scientists and engineers from MIT, chaired by Professor Ernest Moniz, there have been reviews by the JASONS, chaired by Dr. Sidney Drell; the DOD Joint Advisory Committee, chaired by retired Air Force General John Welch; and the Lawrence Livermore National Laboratory “red team,” chartered by the Department of Energy.

All of the above reviews of APT were positive. The JASON review of January 1995 summarized with, and I quote,.

“Our overall conclusion is that APT is a viable option for meeting U.S. needs for tritium production.” The accelerator production tritium system is intrinsically safe and environmentally benign. Its advantages include no contribution to the spent nuclear inventory from the machine that makes tritium. That is because we do not use fissile material to make the neutrons—no direct production of plutonium, uranium or neptunium—thus, no additional nuclear proliferation concerns, no possibility of a nuclear chain reaction. That means there is no possibility of a nuclear—a runaway nuclear process.

With an accelerator, it is possible to use gaseous tritium-producing material. That means you make a factor of 20 less low-level waste than for re—from a reactor system.

Finally, flexibility. That means that an accelerator can adjust the amount of production to meet the requirement and the cost scale with this flexible adjustment in production. We can meet START I or START II requirements and change the cost accordingly.

Finally, APT has far less institutional risk than any reactor solution. In our opinion, it is largely the institutional issues, such as licensing, nonproliferation and public acceptance that are the barriers to reactor implementation. If those barriers did not exist, the reactor approach might prove to be the least costly option for the Nation.

But these barriers do exist, and if they are ever overcome, the cost of overcoming them could drive the cost of a reactor beyond that of an accelerator. If not, the reactor use will remain as a backup in the event there is a national defense emergency.

The APT total estimated cost for the 2 kilogram system developed by an industrial partner in a competitively selected bidding process was $2.2 billion for the 2 kilogram system, including a 31 percent contingency in fiscal year 1995 dollars. This cost is comparable to the estimated capital construction cost of a new reactor. The operating cost of APT is about the same as that of an electricity-producing reactor, but APT does not offer the possibility of generating revenue from electricity sales.

In our opinion, the electrical consumption of APT should not have a significant effect on electric power availability in the Savannah River region. APT uses 0.6 of a percent of the total power in the region. There are 62,000 megawatts of electrical power capacity in the Savannah River region; 55,000 megawatts are used, and there are 10,500 megawatts of excess capacity above the peak demand available.

The accelerator to generate 2 kilograms of tritium requires 400 megawatts. That is 3.4 percent of the excess capacity above the peak demand.

APT is a practical system for providing an assured source of tritium for the Nation's nuclear deterrent. Compared to a reactor, APT has many safety and environmental advantages and fewer institutional barriers. APT uses proven technology, technology that was developed over 40 years of experience in the accelerator community. These machines do run as factories 24 hours a day, safely and with higher reliability.

I would invite you gentlemen to join us at Los Alamos, where we have the highest power linac in the world operating today, with an availability of 90—over 90 percent this year and operating 24 hours a day.

We at Los Alamos also believe that high-power accelerators will find many other applications in the 21st century. APT is a single-mission facility, but we are confident that DOE will decide that APT is the first of those applications.

Thank you for the opportunity to present these remarks.

[The prepared statement of Paul W. Lisowski follows:]

PREPARED STATEMENT OF DR. PAUL W. LISOWSKI, PROJECT LEADER, ACCELERATOR PRODUCTION OF TRITIUM, LOS ALAMOS NATIONAL LABORATORY

Introduction

On October 10, 1995, Energy Secretary Hazel O'Leary announced a dual-track strategy to assure a new tritium source for the United State's nuclear deterrent using either reactor or accelerator technology. In this testimony, I will: compare accelerator production of tritium (APT) to the alternative approach, discuss how we have used proven technology throughout the APT design, explain the advantages that an accelerator brings to tritium production in the areas of safety and environmental impact, present the institutional advantages of accelerator systems, and, discuss the APT project cost and schedule along with that of other large accelerator projects over the past several decades.

How is Tritium Produced?

Production of tritium in a quantity large enough to supply the needs of the stockpile can only be accomplished through neutron capture by a stable isotope such as helium-3 or lithium-6. Presently there are only two practical systems that can make enough neutrons to produce tritium, i.e., reactors and accelerators. In a reactor, nuclear fission supplies the neutrons. In APT, neutrons are made by a process known as spallation in which energetic protons from a linear accelerator interact with heavy metal nuclei, such as tungsten.

Once neutrons are produced, either by fission or spallation, the physical principles that allow them to convert helium-3 or lithium-6 to tritium are the same. Both reactors and accelerators use the same calculational techniques to predict the amount of tritium produced.

The use of spallation to produce neutrons makes it possible to avoid the use of fissile material, which in turn makes the system design both simpler than that of a reactor and provides additional safety and environmental features including: no contribution to the nuclear spent fuel inventory, no production of plutonium, uranium, or neptunium; thus, no additional nuclear proliferation concerns, no possibility of a nuclear chain reaction; thus, no possibility of a run away criticality accident, residual heat after shutdown only 2.5% that of a nuclear power reactor producing the same amount of tritium; thus, simpler emergency cooling requirements, and, use of gaseous tritium-producing feedstock; thus, far less radioactive waste than from reactors.

Overview

If constructed, the APT plant will be located at Savannah River Site, and, based on recent guidance from the Department of Energy, Will have a design production capacity of 2 kg per year upgradable to 3 kg per year. The plant will consist of a proton linear accelerator, beam transport, target/blanket, tritium-extraction, and heat removal systems. Other equipment in the APT plant will be essentially the same as that developed for other large-scale facilities such as power plants, and will incorporate standard technology.

APT will use a modern higher power version of proton linear accelerators that have been in operation for over 40 years worldwide. These accelerators have performed well under long-term, factory-like conditions, operating twenty four hours a day, seven days a week, with periodic shutdowns for maintenance.

The APT system requires no new technology. For an APT system that can produce the required amount of tritium, the technology base is well proven. For example, one of the main capital costs of APT is the radio-frequency power sources that will drive the accelerator. These are used in accelerators worldwide and are available commercially. The APT accelerator structure design is based on that of the Los Alamos high-power linac, which has been operating successfully for 23 years, on other large proton linear accelerators around the world, and on technology developed in the SDI-sponsor Neutral Particle Beam program in the 1984-1992 time frame.

At the end of the accelerator, the beam will be directed to an assembly where tritium is produced. That assembly will consist of a tungsten and lead neutron production target, surrounded by a blanket in which the neutrons are slowed by collisions with water and captured in helium-3 to produce tritium. The slowing down, or moderation process needed to increase the efficiency of tritium production.

Because both tritium and helium-3 are gases, APT can continuously remove tritium from the system. This provides a rapid recovery for the stockpile and greatly lowers the amount of tritium that could potentially be released to the environment. As an alternative, the APT system can produce tritium using lithium-6 alloyed with aluminum, which was used in the past in reactors. However, use of this technology results in additional waste from irradiated feedstock material which must be disposed of.

The APT system has been subjected to several in-depth independent examinations over the past 12 months. In addition a review by scientists and engineers from MIT, chaired by Professor Ernest Moniz, there have been reviews by the JASONs (a prestigious scientific committee chartered by the DoD), chaired by Dr. Sidney Drell; the DoD Joint Advisory Committee, chaired by Retired Air Force General John Welch; and a Lawrence Livermore National Laboratory "red team" investigation. All of the above reviews of APT were positive. The JASON review of January 1095 summarize with:

> *"Our overall conclusion is that APT is a viable option for meeting U.S. needs for tritium production."*

These reviews can be made available to the committee if required.

Safety and Environmental Advantages of APT

APT is a very safe and environmentally benign system. The fundamental reason for this is that its neutrons are produced by spallation instead of by a nuclear fission chain reaction.

The data presented in the following discussions have been taken from the Department of Energy's Programmatic Environmental Impact Statement (PEIS) on Tritium Supply and Recycle.

Because there is no uranium or plutonium used by APT to produce neutrons, there is no contribution to the nuclear spent fuel inventory and also no additional contribution to nuclear proliferation issues. Low level and hazardous wastes are produced in APT in small amounts from the periodic replacement of components. For example, the APT will produce only about 55 cubic-meters of low-level waste per year compared to 3600 cubic meters from a small advanced light water reactor.

The DOE, using numbers generated independently Sandia National Laboratory's analysis of APT Project design information and radioactivity inventory, has shown that there are virtually no consequences to the public from APT off-normal events. For example, in a "severe" accident, the consequences in terms of the cumulative number of induced cancer fatalities within a 50-mile radius of the site are from 2000 to 3000 times higher for reactors than for APT. The probability of such events is extremely small and shows the relative safety advantage of APT.

The residual heat after shutdown for the APT system is minimal when compared to a reactor. For example, the residual power shortly after shutdown in a reactor that makes 3 kg of tritium annually is 60 MW. In comparison, the residual heat in APT for the same tritium production rate is 1.5 MW, or 2.5% of the reactor's. Because of the low decay heat in APT, it is inherently simpler to provide heat removal during an accident. As demonstrated by the Three Mile Island accident, this is sometimes difficult to achieve with a reactor.

The APT design uses continuous tritium extraction from ^{3}He gas that resides in the tritium production assembly. There is no need for a facility to melt solid targets (as in the reactor options) and extract the tritium. Tritium purification to required levels is done using a facility very similar to the Tritium Systems Test Assembly (TSTA) which has been in operation since 1984 at Los Alamos. An estimate of 250 Curies/year tritium release for APT is an upper bound based on extensive experience at TSTA. This can be compared to 5,000 Curies/year expected to be release in routine reactor operations, as documented in the PEIS.

Institutional Advantages of APT

Institutional risk was an important part of the Department of Energy's decision to move ahead with both APT and Commercial Light Water alternatives for the important mission of tritium production. Although we are confident that the accelerator will be chosen as the technology to be implemented, we agree with the DOE dual track strategy.

In our opinion, it is largely the institutional issue's such as licensing, non-proliferation, and public acceptance that are potential barriers to reactor implementation. If those barriers did not exist the reactor approach might prove to be the least costly option for the nation; but these barriers *do* exist, and if they are ever overcome the cost of doing so could drive the cost of a reactor beyond that of an accelerator. If not, reactor use will remain as a backup in the event there is a national defense emergency.

However, because opponents of nuclear reactors have successfully employed a strategy of legal delay to lengthen and even block construction and licensing of nuclear power plants, any reactor approach becomes vulnerable to these same tactics unless the Federal Government is willing to override or sidestep the process. *The risk inherent in the reactor approach must be seen as a risk to the required production date of tritium and therefore to the integrity of the nuclear stockpile.*

In contrast to any reactor approach, institutional barriers are largely, non-existent for APT. This is because the APT will be a non-reactor nuclear facility, and therefore will not be subject to lengthy reactor licensing requirements.

APT does not jeopardize the long-standing United States practice separating use of commercial nuclear power equipment and military material production. The following excerpt is taken from the April, 1994, "Report of the U.S. Utility Industry Advanced Reactor Corporation on the U.S. Advanced Reactor Development Program" and represents the consensus of 15 public utilities, including Carolina Power and Light Company, Duke Power, Georgia Power, and the Tennessee Valley Authority. The cover letter to the DOE for this report was signed by the CEOs of these companies and contained the following statement:

> "DOE should exercise caution when identifying added missions for reactors other than electricity generation.
>
> The last three to five years have seen a significant growth in proposals for advanced power reactors to take on additional missions concurrent with the generation of electricity for federal or commercial use. Examples of such added missions include producing tritium, burning spent fuel actinides, disposing of plutonium, and producing medical isotopes. There is a risk that a dual-purpose reactor will not do either mission very well, as has been demonstrated at Chernobyl. From a practical engineering standpoint, every dual purpose (or "triple play") application should be evaluated carefully to determine if two different reactors performing different missions might be better (from either a safety or economics perspective) than the singe dual purpose machine. From a policy standpoint, the utility industry supports a long-standing tradition of separating commercial and defense uses of reactor technology; that is, to avoid dual purpose reactors that produce both electric power and weapons materials."

Cost and Schedule

APT preconceptual design activities were funded by the DOE and took place from 1992-1995 with the help of a competitively selected industrial support team. Funding during that period was less than $40M.

For the PEIS, the tritium production requirement, and therefore the accelerator power, was higher than the present DOE baseline requirement. The PEIS cost estimate was generated by Bechtel Corporation and the contingency was obtained using their standard approach based on various project uncertainties. To obtain the cost estimate for the 2 kg system, we performed detailed scaling of the costs using the latest design information and applied several cost-saving measures identified requiring further design. The Total Estimated Cost (TEC) is $1.6B without contingency and $2.3B with contingency. The Total Project Cost (TPC), which includes pre-operational costs such as engineering design and demonstration, commissioning, safety and licensing, and conceptual design is $2.2B without contingency and $2.9B with contingency. These costs are in FY1995 dollars.

The annual Operations and Maintenance cost will depend strongly on negotiations with an electric utility for the best rates for the required 400 MW, but will be in the range from $120-200M. The electric power is presently available at Savannah River Site for tritium production and is projected to be available when APT comes on line. This amount of electric power is projected by the electric power industry to be readily available in the Savannah River region. There are several alternative technologies that, if implemented, could reduce the power requirement by up to 50%. With no cost-saving improvements, the Net Present Value (NPV) 40-year life cycle cost using a discount rate of 3.8% is approximately $5B.

Because of the failure of the SSC project, there is the perception that the Department of Energy can not manage large-scale accelerator projects. To address this concern, we have compiled data specifically related to the cost growth of eleven large-scale DOE-supported accelerator projects completed after 1969. Those data compare cost estimates for projects such as the Fermi National Accelerator Laboratory (FNAL) proton synchrotron, the Stanford Linear Accelerator 2-Mile linac, the recent FNAL linear accelerator upgrade, the Argonne National Laboratory Advanced Light Source, and the Continuous Electron Beam Accelerator Facility.

The result of our study is that the average cost growth—from initial total estimated cost at the completion of the conceptual design to final cost—was less than 10% after the effect of inflation is removed. This small cost growth takes on increased importance because in nearly every case the accelerators were first-of-a-kind systems that were built to achieve a significant jump in technology over what had been achieved previously.

In contrast, the APT baseline design, supported by numerous review panels, has virtually no new technology, and therefore we expect no technology-risk-based cost increases in the TEC or TPC beyond that already included in the project contingency.

Engineering Design and Development Program Plan

Virtually all of the APT components have been either sufficiently demonstrated or their performance requirements are within the known engineering design space. There are three important areas that APT will investigate in an Engineering Design and Development program over the next few years: reliable high-power continuous operation, tritium production efficiency, and materials performance. The first two are essentially engineering model prototyping efforts that will lead to more efficient and cost-effective plant design with an adequate margin of tritium production. The third activity will qualify improved structural materials to verify component lifetime and to reduce operations costs.

These activities will be performed with the assistance of a competively selected prime contractor responsible for plant design and construction, and with the Maintenance and Operations Contractor at Savannah River, in order to assure actual plant operations experience. The three components of this plan are:

Reliable High-Power CW Operation—Reliable operation of the low-energy portion of the linac at full power is a key element of APT plant availability. We plan an integrated demonstration of this system. Implemented in stages, it will verify operation of all the front-end accelerating structures with beam. It will run for long periods of time so that overall operational reliability can be assessed.

During the demonstration program, successive subsystems will be fabricated by the Prime Contractor, or subcontractors, and tested. At the completion of this activity, the front-end accelerator for the plant will have been built and tested, and will then be transferred to Savannah River.

Tritium Production Efficiency—The technology associated with generation and moderation of neutrons produced by energetic proton beams on tungsten and lead targets has been demonstrated at neutron sources worldwide. The engineering judgement of the APT design team is that the entire tritium producing assembly can be modeled to better than ± 15% to assure facility performance and to meet the production goal. Tests will be performed to confirm the calculated tritium production efficiency.

Materials Performance—Based on extensive experience, the lifetime of the linac accelerator structure is estimated to be 40 years or longer. The only APT components where radiation damage affects component lifetime and systems maintenance are in the modular tritium-producing subsystem. We plan tests to determine the radiation damage, corrosion, and coolant contamination expected in this subsystem. Completion of these tests will provide confirmation of material selection for plant design.

Summary

The announcement by the Secretary of Energy on October 10, 1995 to pursue a dual-track strategy has set in motion plans that will assure tritium production by using either reactor or accelerator technology. We agree with this strategy and are convinced that the unique advantages of the accelerator approach will lead to a DOE decision to construct an APT plant at the Savannah River Site.

APT is a safe and environmentally benign. The environmental, health and safety advantages include the following:

- no contribution to the nuclear spent fuel inventory
- no production of plutonium, uranium, or neptunium; thus, no nuclear proliferation concerns
- no possibility of a nuclear chain reaction; thus, no possibility of a run away criticality accident
- residual heat after shutdown only 2.5% that of a nuclear power reactor producing the same amount of tritium; thus, simpler emergency cooling requirements
- use of gaseous tritium-producing feedstock; thus, far less radioactive waste than from reactors.

In addition, APT has far less institutional risk than any reactor solution. Issues of licensing, non-proliferation, and public acceptance are potential barriers to reactor production that are not problems for APT. Further, APT does not jeopardize the long standing United States practice separating use of commercial nuclear power equipment from military material production—a policy supported by much of the nuclear power industry.

Opponents of nuclear reactors have successfully employed legal delays to lengthen and block construction and licensing of nuclear power plants. Any reactor approach becomes vulnerable to these same tactics. This vulnerability must be seen as a risk to the required production date of tritium and therefore to the integrity of the nuclear stockpile.

The APT total estimated cost is comparable to that of new reactor construction. The operating cost of APT is higher than that of an electricity-producing reactor, but the electrical power is projected by the utilities to be available in the Savannah River region. Costs for the APT plant were developed by Bechtel and other subcontractors using industry standard estimating techniques.

The APT system requires no new technology. It will use a modern, higher power version of the same proton linear accelerators that have been in operation for over 40 years. Virtually all APT components have been demonstrated at the required performance levels. The accelerator and tritium production system design is based on 23 years of operating experience at the Los Alamos high-power linear accelerator and the associated spallation neutron sources.

The APT system has been extensively examined by independent review committees. All have concluded that the APT system is a viable option for meeting U.S. needs for tritium.

Appendix A—Detailed Description of APT System

Accelerator

For an APT system that can produce the required amount of tritium, the nominal accelerator energy is 1300 MeV, and the beam current is 100 mA. The accelerator is made up of optimized radio-frequency (RF) structures that provide efficient energy gain to the beam over specific velocity ranges. Design of those structures is based on successful large proton linear accelerators at several laboratories around the world, most notably the LANSCE linac at Los Alamos National Laboratory, as well as on technology developed in the SDI-sponsored Neutral Particle Beam program and on high-power radio-frequency (RF) power sources used by several large colliding beam rings.

The accelerator itself has several major subsystems. These include: a low energy "beam-launching" front-end linac section to generate the high-current proton beam, accelerate it to an intermediate energy (100 MeV), and prepare it for the main acceleration stage, a high-energy linac section which accelerates the beam to full energy—1300 MeV, an RF power system to provide the accelerating energy, and, a beam-transport system to deliver the beam to one of two tritium production targets.

With an average accelerating gradient, of 1 million volts/meter, the overall length of the accelerator system is about 1.8 km. This accelerator is housed within a concrete tunnel that is buried under 12 m (39 ft) of earth for radiation shielding.

A continuous stream of protons is generated in an ion source and injected at an energy of 75 keV into a Radio-Frequency Quadrupole (RFQ) linac, where it is formed into bunches at the frequency of the RF power system (350 MHz) and accelerated to 7 MeV. These bunches are further accelerated to 100-MeV in a Coupled-Cavity Drift-Tube Linac (CCDTL), and then to full energy (1300 MeV) in a Coupled-Cavity Linac. The CCDTL and CCL, which are powered by 700-MHz 1-MW RF amplifiers, make up the bulk of the accelerator.

The full-energy beam is directed to one of two target/blanket assemblies located in separate target stations by a beam transport system. This system consists of bending and focusing magnets and evacuated pipes through which the beam travels. The transport system also provides the correct expanded beam size and shape at the target and switches the beam between the two target/blanket assemblies as required. When the beam is not directed onto a production target, it is sent through a third transport channel to a full-power beam stop for tuning the accelerator prior to target operation.

Target / Blanket

After expansion, the beam passes through a metal "window" into one of two identical subterranean target/blanket chambers located at the same elevation as the accelerator. In the target/blanket system, the proton beam strikes heavy-water cooled tungsten rods encased in stainless steel tubing to produce neutrons. Surrounding this central structure, known as the neutron target, is the tritium-producing blanket. The blanket has light-water cooled lead assemblies that contain ^{3}He in aluminum tubes surrounded by a heavy-water neutron reflecting region. The ^{3}He is continuously circulated. A slipstream of the gas is directed to a palladium membrane to remove the tritium and hydrogen produced by the ^{3}He(n,p)T reaction.

The process of separation and purification of the tritium from the other hydrogen isotopes is fully proven and can be performed using present systems in operation at the Los Alamos National Laboratory Tritium Systems Test Assembly and at Savannah River Site. It greatly reduces processing losses and worker exposures previously associated with tritium extraction.

Technology Base Summary

Low-Energy Linac Section: The technology base for the low-energy linac rests largely on advances made in the SDI-supported Neutral Particle Beam (NPB) program at Los Alamos and other labs in the past decade. The design framework developed in this program has been benchmarked on several pulsed accelerators operating with peak currents in the APT regime. Experience in CW operation of injectors and RFQs has been gained at Chalk River, Los Alamos, and elsewhere.

High-Energy Linac Section: The baseline APT accelerator uses designs that have either been proven at equivalent or higher performance levels, or have very high low risk of achieving the required performance based on the opinion of expert review committees. Based on a design developed at Chalk River National Laboratory in Canada, the injector subsystem has already demonstrated proton currents in excess of 130 mA at 75 keV beam energy. The coupled-cavity linac (CCL) used in the high-energy accelerator for the APT system is based on the 25-year-old CCL technology used in the LANSCE accelerator. APT CCL accelerating gradients and frequency are similar to those in LANSCE. Fermilab has recently completed a linac upgrade program in which 400 MeV of CCL structure was fabricated and installed, using a design very similar to the APT system. Most of the fabrication was carried out in industry.

High-Power RF: High-power RF generators (0.5- to 1-MW CW) of the type needed to drive the APT accelerator have been developed for high-energy-physics beam colliders (CERN, DESY, and SLAC). The APT linac needs RF power at 350 MHz and 700 MHz. The first requirement can be satisfied by commercially available klystrons. The second requires a klystron at a new frequency, which falls well within the standard engineering and design space.

Beam Transport: The magnet transport system that carries the proton beam from the end of the APT linac to the production targets is composed of conventional electromagnets typical of those found in every large accelerator installation. A beam expander similar to those needed for APT has been operated, delivering the results predicted by the design codes.

Tritium Processing: The tritium processing facility used in APT was designed by scientists who operate the Los Alamos Tritium Systems Test Assembly, or TSTA. At the TSTA, a closed-loop tritium system is in daily operation to simulate tritium fuel clean-up in a full scale fusion power plant. The experience gained at TSTA has been implemented in the APT design to assure a pure supply of weapons-grade tritium and at the same time maintain exceptionally high standards for tritium release.

Spallation Targets: Extensive experience exists worldwide with the use of accelerator driven spallation neutron sources. At the Los Alamos Neutron Science Center, tungsten neutron spallation neutron sources have been used successfully for over 20 years. Total neutron production efficiency for the APT tungsten-lead spallation target was recently benchmarked at 800 MeV and found to be in agreement with the predictions to within a few percent. Inconel and stainless steel have been used for structural materials and beam entrance windows because of their high temperature strength. In Europe, spallation sources made of uranium, lead, and zirconium are also in operation. On the basis of material damage data from components used at the Los Alamos Neutron Science Center, the most heavily irradiated APT components are known to have a lifetime of 1-3 years.

Balance of Plant: The technology for both the target and balance of plant cooling systems is directly issued from the nuclear power industry. In particular, the design approach elaborated for the NPR Heavy Water Reactor (HWR) cooling systems has been directly applied to the low temperature, low pressure APT target/blankets. This conservative design when combined with already inherently safe targets will provide an unsurpassed level of safety in a production facility.

Mr. SCHAEFER. The Chair thanks the gentleman.

Mr. Christopher Paine, Senior Research Associate, Natural Resources Defense Council.

STATEMENT OF CHRISTOPHER E. PAINE

Mr. PAINE. Yes, Mr. Chairman, I appreciate the opportunity to present the views of the Natural Resources Defense Council regarding the relative urgency and scale of tritium production capabilities for the future nuclear weapons stockpile. Over the last 3 years, actually 3 years ago, I appeared before the House Armed Services Committee on the same subject, and I am struck by how little the congressional debate has advanced since that time.

Much of today's debate continues to miss the point. Given the enormity of the changes in the international security situation that have continued to occur over the past 6 years, I believe it is premature for both accelerator and reactor advocates to be milling around the tritium trough looking for new government contracts.

The real core issue for Congress is not whether you should stuff a new technical project down the taxpayers' throat at this time, whether it be a reactor or an accelerator, or even where to put it, South Carolina or Nevada. The real issue is to determine the national, international security purposes, if any, to be served by retaining nuclear weapons. That is the debate the American public would like you to have.

Assuming that an enduring purpose for some number of nuclear weapons can be identified, we need to decide together, as a nation, how many weapons, of what type, should we be prepared to keep and for how long? After we have gone through that intellectual and philosophical public process, we might begin to have an informed policy debate about the nature and extent of our future production capabilities for tritium.

Today, the Congress is spending on the order of $25 billion a year to deploy what are still vastly overbuilt nuclear forces, to—in my mind—no discernible public purpose. The Warsaw Pact threat to our NATO allies has dissolved, and therefore, no longer requires deterring with either conventional or nuclear weapons. While always tenuous at best, today no one can even construct a U.S.-Russian crisis scenario leading to a deliberate bolt-out-of-the-blue attack on the continental United States, a threat we were told that had to be actively deterred during the cold war by an overwhelming preemptive counterforce capability consisting of many thousands of hard target kill weapons, and yet today many thousands of U.S. and Russian warheads are still out there hiding in their silos, skulking about the oceans, ready to execute war plans that are, in my view, the genocidal remnant of an age when nuclear dinosaurs roamed the Earth, threatening obliterate everything in their path.

The principal nuclear threat to the U.S. today is not a deliberate Russian strike, but the very existence of alert Russian—and other—nuclear forces, the very existence of those forces, forces which could malfunction or escape positive control at any time. We need to be concerned about the decaying Russian industrial complex that built these forces, and now also poses a proliferation threat.

Our major security objective must continue to be dealerting and systematically eliminating those nuclear forces that pose a threat to us; and achieving that goal will require us to continually reduce our own nuclear forces.

So let's begin the debate at the beginning. How many weapons do we have? How many are we planning to have? How many should we have? And how does our very large but steadily shrinking inventory of tritium relate to these numbers?

For over a decade the Natural Resources Defense Council has maintained an independent, unclassified data base on the U.S. and other nuclear arsenals. While rarely matching precisely the official classified estimates, our estimates have proven reasonably accurate over the years, so much so that they are used by government officials as an unclassified source for journalists and the public.

Mr. Chairman, attached to my testimony, you will find a table, Table 1, that provides our most recent estimate of the U.S. nuclear stockpile and our projection of the nuclear weapons now planned for retention under START II by the year 2003. We estimate that since 1988 about 35 percent of the U.S. nuclear weapons stockpile has been dismantled, but today the U.S. still has about 15,400 intact nuclear weapons, of which about 4,400 are retired weapons awaiting disassembly. The other 11,000 weapons still in the U.S. nuclear stockpile consist of about 7,800 operational strategic weapons, 1,150 operational nonstrategic weapons, 900 spares and 1,100, quote, "reserve" weapons that could be restored to active service.

As shown in the table under START II, the Department of Defense is planning to reduce the total U.S. nuclear weapons stockpile to about 7,400 weapons, composed of the following: 3,500 operational strategic weapons, the figure that most journalists and the public have in their mind; 950 non-strategic weapons, which are rarely mentioned; 450 spares and about 2,500 "reserve" or "hedge" weapons which could, again, be restored to active service under certain circumstances.

The remaining balance of roughly 8,000 weapons will eventually be dismantled, but under current plans, almost all the plutonium pits from these weapons—some 7,800 by our estimate—will be retained in a "strategic plutonium reserve" for potential military use.

Now, according to the Department of Energy, if you look at Figure 1, which follows Table 1, a START II-compatible active stockpile, which by our estimate would be composed of some 4,900 weapons, can be supported with a 5-year reserve until approximately the year 2011 without fresh supplies of tritium. The same number of weapons could be supported for another 5 years, until approximately 2016—and that is the Department of Energy's estimate I am quoting, their estimate, until quote approximately by 2016—by using up the designated "reserve" inventory. Alternatively, the reserve could be used to support for a shorter period of time the redeployment of an uploaded strategic force of some 6,000 weapons as the putative U.S. response to a future crisis involving Russia.

Let us put aside for a moment whether the redeployment of nuclear weapons would be a rational response to any crisis with Russia and look at that 4,900 figure.

Like the Seawolf submarine and the B–2 bomber, I think these bloated planning assumptions are just one more echo of a nuclear combat mentality that has outlived the conflict that originally spawned it. Only Russia and the U.S.—nations that together once accumulated 70,000 nuclear weapons—only those nations could possibly regard the levels contemplated for retention under START II as anything but grossly excessive. It borders on the idiotic for the Pentagon to be suggesting that it might be a rational response to any difficulty in the Soviet Union to deploy additional weapons.

In what way would those weapons ameliorate any difficulties that we might have with the Soviet Union or, I should say, with Russia in the future? Why is it that China, a nation of 1.27 billion people, is able to meet its nuclear deterrent requirements with fewer than 500 operational weapons? The same is true of our allies, France and the United Kingdom. Why then did the U.S. and Russia continue to require 10 times as many weapons?

To illustrate the impact of deep reductions on our tritium supply situation, let us assume that Presidents Clinton and Yeltsin come to their senses, override the parochialism and the careerism of their respected national security establishments, agree at this next so-called "nuclear safety" summit, scheduled for next spring, to move beyond the straitjacket of START II and begin negotiations on verified irreversible stockpile reductions—not just launcher or delivery system reductions, nuclear weapon stockpile reductions to the level of 1,000 total warheads in each nation. As shown in the Figures 2-A and 2-B attached to my testimony, the dwindling inventory of tritium will nonetheless be sufficient to support a 1,000-warhead stockpile at least until the year 2025.

If one assumes that additional tritium could be found in the so-called "fixed inventory" in our very large purification and loading pipeline and that—those kilograms could be put back into weapons, then 1,000 weapons could be maintained for another decade until about the year 2035. An intermediate force level, such as 2,500 total weapons could be supported until the year 2019, including a 2-year reserve. A lower force level, such as 500 weapons, could be supported until the year 2045.

Mr. SCHAEFER. If the gentleman could summarize, wrap up.

Mr. PAINE. Thus, by any reasonable measure, the United States has plenty of time to make the tritium decision. Given the likelihood of further nuclear arms reduction in the next 30 years, the taxpayers have every interest in seeing that the Congress does not make this determination prematurely, thereby saddling them with an oversized or obsolescent capability, something more than is absolutely necessary to operate and maintain our nuclear deterrent.

I have some comments on the specifics of the Speaker's Task Force Report which I will skip and simply move to the conclusion, Mr. Chairman——

Mr. SCHAEFER. As I state, all your testimony will be part of the record.

Mr. PAINE. Thank you.

What we need to do here is to follow this tritium decay curve down. And if you look at the chart that I have in there for a 1,000-warhead stockpile, you will see an enormous gap between the requirement to maintain 1,000 warheads and our existing inventory. So I don't think anybody in this room would maintain that even if we were stuck with only 1,000 warheads that we would be absent a very credible nuclear deterrent.

So what is this debate about? Why are we having this debate now about accelerators versus reactors versus triple-play and so forth? I think the rational way to proceed is to follow that tritium decay curve down and to have in our hip pocket the capability to produce whatever amount of tritium we need to maintain the reduced stockpile from commercial reactors, either a reactor that has been Federalized, a reactor that has been taken over under a long-term lease arrangement or based on contractual services.

The President has the authority under the Atomic Energy Act to use commercial facilities if there is a national emergency, and I think that is the only situation under which we should produce additional tritium if the country really genuinely needs it, not to provide esoteric war planning options for our military, not to provide bogus arms race responses to difficulties in our relations with Russia.

Thank you.

[The prepared statement of Christopher E. Paine follows:]

PREPARED STATEMENT OF CHRISTOPHER E. PAINE, SENIOR RESEARCH ASSOCIATE, NATURAL RESOURCES DEFENSE COUNCIL

Mr. Chairman, I appreciate this opportunity to present the views of the Natural Resources Defense Council regarding the relative urgency and scale of tritium production capabilities for the future nuclear weapons stockpile. Over three years ago, I appeared before the House Armed Services Committee on this same subject, and I am struck by how little the congressional debate has advanced since that time.

In my view, much of today's debate continues to miss the point. Given the enormity of the changes in the international security situation that have continued to occur over the past six years, it is premature for both accelerator and reactor advocates to be rooting around the tritium trough. The real core issue for Congress to consider is not which techno-pork to stuff down the taxpayers throat—a new reactor or a new proton accelerator—or even where to put it—South Carolina or Nevada—but rather to determine the national and international security purposes, if any, to be served by retaining nuclear weapons. That is the debate that the American public would like you to have. Assuming that an enduring purpose for some number of nuclear weapons can be identified, how many weapons, of what type, should we be prepared to keep, and for how long? After we have gone through that intellectual and philosophical public process, we might begin to have an intelligent policy debate about the nature and extent of future production capability for tritium.

Today the Congress is spending on the order of $25 billion per year to deploy what are still vastly overbuilt nuclear forces, to no discernible public purpose. The Warsaw Pact threat to our NATO allies has dissolved, and therefore no longer requires "deterring" with either conventional or nuclear weapons. While always tenuous at best, today one can no longer even *construct* a U.S.-Russian crisis scenario leading to a deliberate "bolt-out-of-the blue" attack on the continental United States—a threat, we were told, that had to be actively deterred during the Cold War by an overwhelming preemptive counterforce capability. And yet, thousands of U.S. and Russian warheads are still out there, hiding in their silos or skulking about the oceans, ready to execute war plans that are the genocidal remnant of an age when gargantuan nuclear dinosaurs roamed the earth, threatening to obliterate everything in their path. The principal nuclear threat to the U.S. today is not a deliberate Russian nuclear strike, but the very existence of alert Russian (and other) nuclear forces—forces which could malfunction or escape positive control at any time. We also need to be concerned about the decaying Russian industrial complex that built these forces, and now poses a proliferation threat.

So let's begin this debate at the beginning—how many weapons do we have, how many are we planning to have, how many should we have, and how does our very large but steadily shrinking inventory of tritium relate to each of these numbers? For over a decade, the Natural Resources Defense Council has maintained an independent, unclassified database on the U.S. and other nuclear arsenals. While rarely matching precisely official classified figures, these estimates have proven reasonably accurate over the years, so much so that they are used by government officials as an unclassified source for journalists and the public. Table 1 provides our most recent estimate of the U.S. nuclear stockpile (as of the end of FY 1995) and our projection of the nuclear weapons now planned for retention under START II by the year 2003, the deadline for full implementation of the treaty.

An important benchmark for our tritium and stockpile estimates was provided by the Reagan Administration, which reported to Congress in February 1987 that the U.S. nuclear weapons stockpile was composed of 23,400 weapons.[1] In line with this report, we estimate that the U.S. had 23,000 nuclear weapons, most of which required tritium, when production ceased at Savannah River in 1988. By establishing how much additional tritium this huge force required annually to offset what was lost to radioactive decay, one can estimate the approximate initial tritium inventory, and thus how long this inventory can support an arsenal of a given size. In December 1988, DOE reported to Congress that a second, backup New Production Reactor (NPR) "should be a Modular High-Temperature Gas-Cooled [MHTGR]... sized to provide capacity for preproduction of tritium for contingency purposes and *for sufficient makeup tritium for maintaining the stockpile* in case of a protracted loss of the HWR [Heavy Water Reactor].[2] The proposed MHTGR plant design had a total thermal power of 1400 Mw. This information allowed us to calculate a rough estimate of the "plutonium equivalent" production capacity for this reactor, which in turn implied a tritium production capacity of 5.35 kg annually.[3]

We therefore assumed that 5.35 kg represented the "steady-state" tritium "makeup" requirement for a stockpile of 23,000 warheads. Dividing this number by the decay rate, we estimated that the total required inventory, including the supply pipeline, was just under 100 kg. (535kg/0.055 = 97.3 kg.). We also modeled a larger comparison case by adjusting this base figure upward by about 15 kilograms to reflect a larger assumption about the amount of tritium tied up in tritium purification and loading facilities, in the lengthy overseas reservoir exchange pipeline, and in "reserve" stocks.

We estimate that since 1988, about 35% of the U.S. nuclear weapons stockpile has been dismantled. Today the U.S. still has about 15,400 intact nuclear weapons, of which about 4400 are retired weapons awaiting disassembly. The other 11,000 weapons, still in the U.S. nuclear stockpile, consist of about 7,800 operational strategic weapons, 1,150 operational non-strategic weapons, 900 spares, and 1,100 "reserve" weapons that could be restored to active service. As shown in Table 1, under START II the Department of Defense is planning to reduce the total U.S. nuclear weapons stockpile to about 7,400 weapons, composed of the following: 3,500 operational strategic weapons, 950 nonstrategic weapons, 450 spares, and 2,500 "reserve" or "hedge" weapons. The remaining balance of roughly 8,000 weapons will eventually be dismantled, but under current plans almost all the plutonium pits from these weapons—some 7,800 of them by our estimate—will be retained in a "strategic plutonium reserve" for potential military use.

According to the Department of Energy (see Figure 1), a START II compatible active stockpile (by our estimate composed of some 4900 weapons) can be supported with a five-year reserve until "approximately" the year 2011 without fresh supplies of tritium. The same number of weapons could be supported for another five years, until "approximately 2016" by using up the designated "reserve" inventory. Alternatively, the reserve could be used to support, for a shorter period of time, redeployment of an "uploaded" strategic force of some 6000 weapons as the putative U.S. response to a future "crisis" involving Russia.

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[1] HASC, FY 1988, p. 48.

[2] Emphasis added. See Report to Congress by the President, "United States Department of Energy Nuclear Weapons Modernization Report," December 1988, p. 14–15.

[3] The basis for this calculation is further explained in "Awash in Tritium: Maintaining the Nuclear Weapons Stockpile in an Era of Deep Reductions," prepared Testimony of Christopher E. Paine, Senior Research Associate, NRDC before the Panel on Defense Nuclear Facilities, HASC, April 6, 1992.

Like the Seawolf submarine and the B-2 bomber, these bloated planning assumptions are just one more echo of a nuclear combat mentality that has outlived the conflict that originally spawned it. Only Russia and the U.S.—nations that together accumulated some 70,000 nuclear weapons—could possibly regard the levels contemplated for retention under START II as anything but grossly excessive. Why is it that China, a nation of some 1.2 billion people, is able to meet its nuclear deterrent requirements with fewer than 500 operational weapons, as are France and the United Kingdom.

For illustrative purposes, let us assume that Presidents Clinton and Yeltsin come to their senses, override the parochialism and careerism of their respective national security establishments, and agree at the so-called "nuclear safety" summit scheduled for next spring to move beyond the straitjacket of START II to begin negotiations on verified irreversible nuclear stockpile reductions to the level of 1000 total warheads in each nation—still twice the level of the next largest arsenal. As shown in Figures 2-A and -B, and their accompanying tables, the dwindling existing inventory of tritium will nonetheless be sufficient to support a 1000-warhead stockpile until at least the year 2025. If one assumes that 5 kilograms of the tritium from the so-called "fixed inventory," now held in the Cold War scale purification and loading pipeline, can be put back into weapons, 1000 weapons could be maintained for another decade, until about the year 2035, without additional production of tritium. An intermediate force level, such as 2500 total weapons, could be supported until around the year 2019. A lower force level such as 500 weapons could be supported until about the year 2045.

Thus by any reasonable measure, the United States has plenty of time to make this tritium production decision, and given the political likelihood of further nuclear arms reductions in the next 15 years, the taxpayers have every interest in seeing that Congress does not make this determination prematurely, thereby saddling them with an oversized or obsolescent capability that will cost them more than absolutely necessary to operate and maintain.

Turning to the Speaker's Task Force Report, while I agree with a few of its observations, the report as a whole suffers from the deficiency of assuming into existence the very strategic premises and requirements that are inherently uncertain and therefore in dispute. The DOE's Programmatic Environmental Impact Statement suffers from the same deficiency, because the Administration's currently approved "Nuclear Weapons Stockpile Plan" (NWSP) does not—indeed cannot—represent the horizon of reasonable alternatives for future tritium production. This disconnect arises because the period covered by the NWSP (1995–2005) does not extend through the construction phase, and does not even begin to address the operational phase (2010–2050) of DOE's proposed tritium supply and recycling capability.

An objective analysis of tritium supply and recycle capability for the years 2010–2050 must take into account reasonable—indeed likely—alternatives not presently accounted for in the NWSP for 1994. By definition, the range of "reasonable alternatives" for tritium supply in the first half of the 21st century cannot be narrowed to sole consideration of the tritium "requirement" in an *already approved* government plan for the period 1995–2005. Not only does such a premature narrowing of options make a mockery of NEPA's requirement for analysis of reasonable alternatives, but the NWSPs themselves historically have been unreliable predictors of actual nuclear weapon requirements and force levels. They have in fact regularly overestimated future nuclear materials requirements.

Moreover, the NWSP is by no means the only source of government approved guidance bearing on the question of long-term tritium supply arrangements, now or in the future. For example, on May 11, 1995, the United States Government, in concert with the other nuclear weapon state parties to the Nuclear Nonproliferation Treaty (NPT), adopted a "programme of action" for "the determined pursuit by the nuclear weapon-states of systematic and progressive efforts to reduce nuclear weapons globally, with the ultimate goal of eliminating those weapons..."[4] An appropriate analysis of "reasonable alternatives" would therefore include the following:

(a) a stockpile drawdown versus tritium inventory decay curve, based on the "No Action" alternative for tritium supply, and on optimized purification, loading and reservoir exchange capabilities, showing year-by-year reductions and reconfigurations of the stockpile to adapt to a decaying tritium inventory. This analysis should incorporate various prospective "stopping points" along this drawdown curve, based on reasonable, alternative projections of future stockpile sizes and their corresponding "steady-state" tritium requirements. Points along this curve should reasonably include the possibility of:

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[4] 1995 Review and Extension Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, "Principles and Objectives for Nuclear Non-Proliferation and Disarmament," NPT/CONF. 1995/L.S., 9 May 1995, p. 2.

(1) the elimination of existing arsenals, as advocated by President Reagan, Persian Gulf air war commander General Charles Horner, and Greenpeace, by or before the year 2050—the time horizon of the present PEIS—achieved on a schedule faster than or equal to that mandated by the decay rate of tritium;

(2) a future "minimum deterrent" stockpile of 10 to 100 nuclear weapons, as advocated by a number of senior retired defense officials, such as former SACEUR General Andrew Goodpaster, former Secretary of Defense Robert McNamara, Livermore Director Herbert York, and others;

(3) START III and subsequent negotiated and/or unilateral reductions leading to a total stockpile of 1000 deployed warheads, as advocated by the former Chairman of the Joint Chiefs of Staff, Admiral William Crowe, former National Security Adviser McGeorge Bundy, and JASON Panel Chairman Sidney Drell;

(4) a START III Treaty by the year 2008 (i.e. five years after the treaty deadline for completion of START II reductions), leading to a *total* U.S. stockpile of 2500 warheads—a 50% reduction from the currently planned level of about 5000 operational and 2500 "inactive reserve" weapons;

(b) ratification, entry into force, and full implementation by Russia and the U.S. of the START II Treaty, leading to elimination after 2003 of the "inactive reserve" component—amounting to approximately 2500 weapons—of the current NWSP that is now slated for retention as a "hedge" against Russian noncompliance with START II. The size of this inactive reserve influences both the timing and scale of production capabilities needed to replenish the intended five-year tritium reserve in the event of a missile uploading "contingency," which in all probability will no longer be required after 2003. In any event, the potential *lack of a need* for the "hedge" will be known seven years *before* the planned 2010 startup of a new tritium source, and therefore this possibility must be explicitly included in current reasonable alternative projections of future tritium requirements.

(c) reduction of any long-term tritium "reserve" from the current five years to whatever is prudently needed as a working and "pipeline" inventory to ensure smooth operation of downsized and reoptimized tritium extraction, purification, reservoir loading, and reservoir exchange operations, pending startup of contingency production in the burnable poison rods of existing Light Water Reactors (LWRs).

The Task Force Report provides no analysis in support of its finding (#1) that combining the tritium production and plutonium disposition missions would be cost-effective, even though this conclusion appears to be the major thrust of the report. The Task Force seems to have missed a primary message of the NAS Plutonium Disposition Study—that the huge capital investment and delay involved in building a new reactor cannot be justified to convert just 20–50 metric tons of separated weapons plutonium to a condition that makes it analogous to the roughly 800 hundred tons of plutonium already in spent fuel worldwide. Conversion to "the spent fuel standard" in existing commercial reactors, or vitrification with the high level waste from which the plutonium was originally separated, appeared to the Academy to be the most cost-effective and timely disposal options worthy of detailed study.

Concerning the Task Force's Finding #2, in the Final PEIS for Tritium Supply and Recycling the DOE dropped its exclusion of commercial reactors as potential candidates for future tritium production. We likewise objected to this exclusion, and filed lengthy comments on the Draft PEIS that set forth in detail why the United States should consider such options, and why, from a nonproliferation perspective, they should be considered on a par with the production reactor and accelerator alternatives. While longstanding U.S. policy discourages the use of commercial civilian nuclear facilities for military purposes, we argued that this policy has not applied to the use of *military* nuclear facilities for *civilian* purposes. Indeed, the N-reactor at Hanford produced plutonium for weapons *and* steam for electric power production for more than two decades, and Russian plutonium production reactors have long provided heat and electricity to their surrounding communities. The DOE purchase/completion option for an existing LWR would convert the reactor involved to a government-run defense mission involving (potentially) the ancillary production of steam for commercial generation of electricity. DOE could own and operate the steam turbines and generators itself, or these could be owned and operated by a "civil" public utility that purchased steam from the DOE "military" plant. The nonproliferation policy implications of the reactor purchase option are not sufficiently different from the Advanced LWR alternative, which includes the use of a next-generation civil reactor design and the generation of electricity for commercial sale.

Moreover, the United States and its allies *have* used "civilian nuclear facilities" for "military purposes." The United States has used its enrichment plants to make highly enriched uranium for nuclear weapons and nuclear missile submarine reactor fuel. The United States also extracted the highly-enriched uranium from spent civilian research reactor fuel and used it as "driver fuel" to produce tritium and plutonium for weapons at the Savannah River Site. U.S. allies France and the United Kingdom operate spent fuel reprocessing plants that have simultaneously served both civilian and military purposes. France has produced weapons plutonium in dual-purpose reactors and nominally "civil" reactors, such as the Rapsodie and Phenix fast breeder reactors. It is useful to recall that under the NPT, the vast majority of countries in the world are not allowed to maintain nuclear facilities for military purposes, so the issue of "separation" never arises. While a clear separation of civil from military programs in nuclear weapon states is politically desirable, to discourage "misuse" of civil nuclear energy facilities for military purposes in nuclear threshold states, as discussed below, the universe of countries where this distinction applies is quite small, and the U.S. "example" may in fact be of little actual relevance.

Indeed, nothing in existing nonproliferation law or practice suggests that the United States could not "*legally* produce tritium for military or civil purposes in a "civil" reactor. Indeed, tritium is not a material subject to IAEA safeguards, is not regarded as central to the proliferation problem, and is also produced for civil purposes, such as runway lighting and fusion energy research. "Federalizing" such a "civil" reactor under DOE ownership would be sufficient to harmonize this option with the nonproliferation "optics" allegedly demanded by present policy. Indeed, the tritium could be produced under IAEA safeguards to assure other nations that the DOE reactor was not also being used to produce plutonium for military purposes.

There are a number of existing commercial reactors in the U.S. today that are candidates for early retirement because they have operation and maintenance costs in excess of $.04 per Kwh, the approximate cost of electricity from competing sources. Because these reactors operate at a loss, the possibility exists that DOE might be able to purchase such a reactor for virtually nothing, particularly if DOE assumes the full decommissioning cost. The possibilities for such an early retirement "buyout" of an existing commercial reactor should be fully explored.

Advocates of building a new production reactor tend to overstate the proliferation significance of another potentially cost effective option—U.S. production of tritium in multiple civil LWR's using lithium target rods in the burnable poison position. Three points are relevant here. First, from a proliferation perspective, only those countries that already have nuclear weapons, *and* are seeking to advance to DT-boosted and two-stage thermonuclear weapons, would be in a position to point to the DOE's action and possibly seek to take advantage of it to justify a similar program. Which are these countries? For the last two decades, they have been India, Pakistan, and Israel—i.e. countries outside of the NPT with significant nuclear weapons capabilities. But Israel and Pakistan have no "civil" nuclear programs to speak of, and India already uses its "civil" reactors to produce unsafeguarded plutonium for weapons. Second, should they so desire, any non-weapon state party to the NPT could legally produce tritium in safeguarded civil reactors, or in *unsafeguarded* accelerators as long as no fissionable materials were present. Third, the key issue from a nonproliferation perspective is not the production of tritium per se in a civil reactor, but its extraction, purification, and loading into D-T reservoirs for use in nuclear weapons, steps analogous to the chemical separation of plutonium from spent fuel and its conversion to metal for use in weapons. These steps in the cycle would remain in government-owned, defense program facilities, and thus would not create a precedent that would allegedly "encourage" the "abuse" of "civil" reprocessing plants for military purposes.

Today, there is no legal or other barrier to Japanese or German production of tritium in safeguarded civil reactors for their fusion energy research programs, should they choose to do so. Since Japan is already producing and separating tons of *weapon-usable* plutonium in its safeguarded civil nuclear facilities—including *weapon-grade* plutonium from breeder reactor blankets—the production of tritium in safeguarded civil nuclear facilities alters the proliferation picture very little, if at all. At most, one could logically argue that any future tritium production, extraction, purification or utilization in non-weapon states should occur under safeguards. Unless one is willing to bar the civil production of *inherently weapon-usable* separated plutonium, it makes no sense to arbitrarily apply a higher nonproliferation standard to production of tritium—a less strategically significant material—in "civil reactors, particularly when the penalty for doing so could well amount to *several billion dol-*

lars in additional spending on nuclear weapons—a fact that is itself not devoid of political significance for nonproliferation.

On the other hand, if the fear is that a country might cite "the U.S. example" to justify using a "civil reactor" for some *other* military use, such as plutonium production, the U.S. could preempt such a response by placing the civil reactors involved in control rod production of tritium under IAEA safeguards, and insist that any country contemplating similar production should do likewise.

In conclusion, Mr. Chairman, I think the wisest course of action would be characterized by the following steps:

(1) Vigorously pursue negotiation of a START III agreement even as we attempt to achieve ratification of the START II agreement. It is simply not true that a Russian political failure to ratify this treaty this year means that the arms reduction process is dead. On the contrary, you will recall that the U.S. failure to ratify the SALT II treaty did not prevent negotiation and entry into force of the INF and START I treaties. Providing the Russians with the incentive of a follow-on agreement that will allow the perceived inequities of START II to be redressed at some lower level of forces is probably the surest path to START II ratification.

(2) Inaugurate a congressional and national debate on the future role of nuclear deterrent forces in national and international security. We need to discuss as a nation whether we and other nations should continue to deploy nuclear forces, and if so, how many, for what purposes, and for how long.

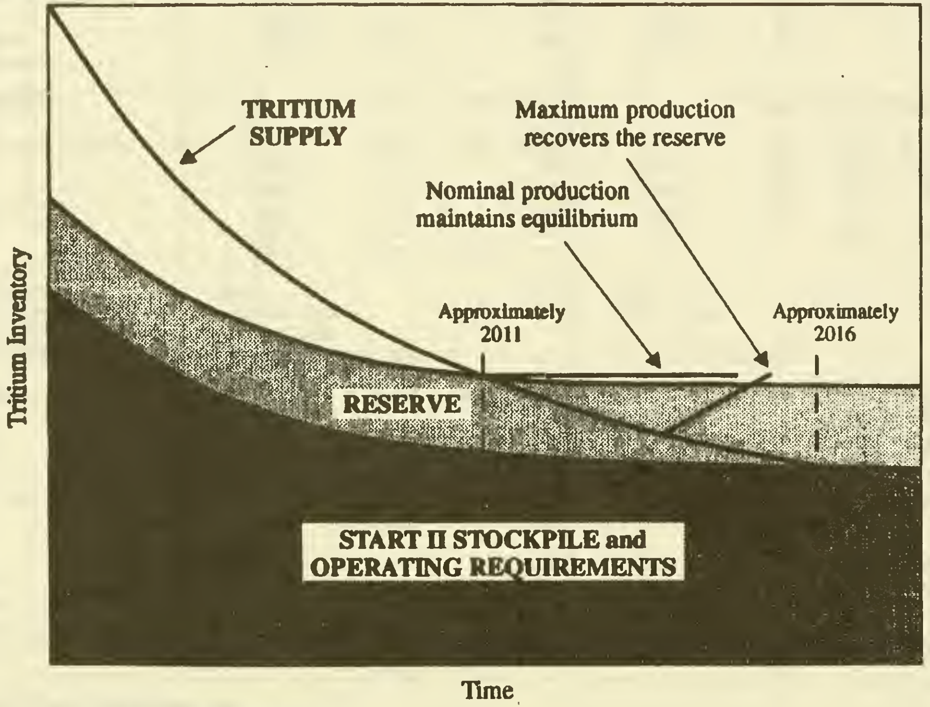
(3) Pursue a long-term tritium supply strategy that is economical, flexible, and sensitive to the political pressures and opportunities for a continuing open-ended process of nuclear weapons reduction. These criteria lead one in the direction of primary reliance on the existing tritium inventory, coupled to a contingent production capability in commercial LWR's, via outright "federalization" of an existing reactor, a long-term lease option arrangement, or contingent long-term contracts for the procurement of irradiation services.

(4) If the future tritium requirement comes down significantly, and sufficient legitimate alternative uses (e.g. medical isotope production, materials testing, dense material imaging, basic scientific research) can be identified to justify the additional R&D and capital investment, an accelerator might prove to be attractive, particularly if its electricity requirements were reduced to the point that it could be powered entirely by energy conservation improvements to the existing grid. However, I regard the vast ATP project as currently described in the PEIS as on a par with the various proposals for a new "triple play reactor"—they are both attempts by special interests long accustomed to wallowing in government support to prolong their stay at the public trough. I'm frankly surprised that either one of these proposals would garner the support of avowed fiscal conservatives and free market advocates. After the expenditure of tens of billions of taxpayer dollars on the development of civil nuclear energy, the nuclear power industry should be regarded as a mature industry capable of generating its own venture capital financing, if and when the economics of nuclear power generation justify the confidence of private investors. As for the accelerator, with its high up-front costs in R&D and construction, it is quite clearly not the current least-cost option for meeting future tritium requirements.

Table 1. U.S. Nuclear Weapons Stockpile.
(NRDC Estimates--Revised 15 September 1995)

	1995					2003				
Weapon System Category	SNDVs	Warhead	Active	Reserve	Total	SNDVs	Warhead	Active	Reserve	Total
STRATEGIC:										
Minuteman III	300	W78	900		900	500	W87	500		500
	230	W62	690		690		W78		900	900
MX	50	W87	500		500					
Subtotal - ICBM	**580**		**2,090**		**1,590**	**500**		**500**	**900**	**1,400**
Trident I C4	336	W76	2,688	384	3,072					
Trident II D5	48	W88	384		384	259	W76	1,295	450	1,745
						77	W88	385		385
Subtotal - SLBM	**384**		**3,072**	**384**	**3,456**	**336**		**1,680**	**450**	**2,130**
B52H (up to 20 ALCM/ACM/bombs)	93	W80-1/B53/B61-7/B83				66	W80-1/B53/B61-7/B83			
B1B (up to 24 gravity bombs)	82	B61-7/B83				0				
B2 (up to 16 gravity bombs)	8	B61-7/B83				20	B61-7/B83			
Subtotal - Bombers	**181**					**86**				
ALCM		W80-1	800	400	1,200					
ACM		W80-1	400		400		W80-1	400	400	800
Gravity Bombs		B53	50		50		B53	0		
		B83	650		650		B83	420	300	720
		B61-7	750		750		B61-7	500	100	600
Subtotal - Bomber Weapons			**2,650**	**400**	**3,050**			**1,320**	**800**	**2,120**
Subtotal - Strategic			**7,812**	**784**	**8,596**			**3,500**	**2,150**	**5,650**
NON-STRATEGIC:										
Gravity Bombs		B61-3/4/10	800		800		B61-3/4/10	600		600
SLCM		W80-0	350		350		W80-0	350		350
Cruise Missile		W84		350	350		W84		350	350
Subtotal - Non-Strategic			**1,150**	**350**	**1,500**			**950**	**350**	**1,300**
STRATEGIC + NON-STRATEGIC			8,962	1,134	10,096			4,450	2,500	6,950
Spares (10% of Active Inventory)			896		896			445		445
TOTAL			9,858	1,134	10,992			4,895	2,500	7,395

Figure 1: 4900 Warhead Stockpile



Note: Drawing has no scale or proportion.

Figure 2-A: 1000 Warhead Stockpile - Base Case

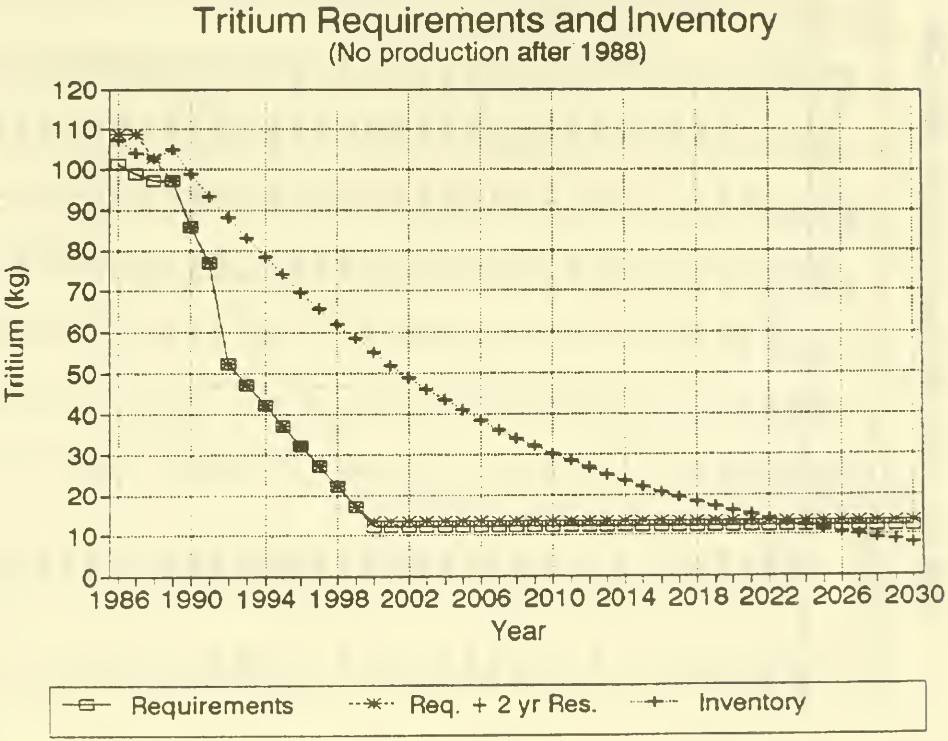


Table 2-A: 1000 Warhead Stockpile - Base Case

Begin CY	Warheads	T Req WH+PL (kg)	Req + 2 y Res.	Req + 5 y Res.	T Inv. (kg)	T Inv. Decay (kg)	T Prod. (kg)	T Sales (kg)	Net T Inv. Chang	T/WH (g)
1986	24,000	101.3	109.0	115.3	107.2	-5.89	3.01	-0.18	-3.06	4.22
1987	23,400	99.0	109.0	109.0	104.1	-5.72	4.73	-0.18	-1.17	4.23
1988	23,000	97.3	103.0	103.0	103.0	-5.66	8.04	-0.25	2.13	4.23
1989	23,000	97.3	97.3	97.3	105.1	-5.78	0.00	-0.18	-5.96	4.23
1990	20,942	86.1	86.1	86.1	99.1	-5.45	0.00	-0.18	-5.63	4.11
1991	18,884	77.0	77.0	77.0	93.5	-5.14	0.00	-0.12	-5.26	4.08
1992	11,736	52.2	52.2	52.2	88.2	-4.85	0.00	-0.15	-5.00	4.45
1993	10,394	47.2	47.2	47.2	83.2	-4.58	0.00	-0.15	-4.73	4.54
1994	9,052	42.2	42.2	42.2	78.5	-4.32	0.00	-0.15	-4.47	4.66
1995	7,710	37.2	37.2	37.2	74.0	-4.07	0.00	-0.15	-4.22	4.82
1996	6,368	32.2	32.2	32.2	69.8	-3.84	0.00	-0.15	-3.99	5.05
1997	5,026	27.1	27.1	27.1	65.8	-3.62	0.00	-0.15	-3.77	5.40
1998	3,684	22.1	22.1	22.1	62.1	-3.41	0.00	-0.15	-3.56	6.01
1999	2,342	17.1	17.1	17.1	58.5	-3.22	0.00	-0.15	-3.37	7.31
2000	1,000	12.1	13.5	16.1	55.1	-3.03	0.00	-0.15	-3.18	12.10
2001	1,000	12.1	13.5	16.1	52.0	-2.86	0.00	-0.15	-3.01	12.10
2002	1,000	12.1	13.5	16.1	49.0	-2.69	0.00	-0.15	-2.84	12.10
2003	1,000	12.1	13.5	16.1	46.1	-2.53	0.00	-0.15	-2.68	12.10
2004	1,000	12.1	13.5	16.1	43.4	-2.39	0.00	-0.15	-2.54	12.10
2005	1,000	12.1	13.5	16.1	40.9	-2.25	0.00	-0.15	-2.40	12.10
2006	1,000	12.1	13.5	16.1	38.5	-2.12	0.00	-0.15	-2.27	12.10
2007	1,000	12.1	13.5	16.1	36.2	-1.99	0.00	-0.15	-2.14	12.10
2008	1,000	12.1	13.5	16.1	34.1	-1.87	0.00	-0.15	-2.02	12.10
2009	1,000	12.1	13.5	16.1	32.1	-1.76	0.00	-0.15	-1.91	12.10
2010	1,000	12.1	13.5	16.1	30.2	-1.66	0.00	-0.15	-1.81	12.10
2011	1,000	12.1	13.5	16.1	28.3	-1.56	0.00	-0.15	-1.71	12.10
2012	1,000	12.1	13.5	16.1	26.6	-1.46	0.00	-0.15	-1.61	12.10
2013	1,000	12.1	13.5	16.1	25.0	-1.38	0.00	-0.15	-1.53	12.10
2014	1,000	12.1	13.5	16.1	23.5	-1.29	0.00	-0.15	-1.44	12.10
2015	1,000	12.1	13.5	16.1	22.1	-1.21	0.00	-0.15	-1.36	12.10
2016	1,000	12.1	13.5	16.1	20.7	-1.14	0.00	-0.15	-1.29	12.10
2017	1,000	12.1	13.5	16.1	19.4	-1.07	0.00	-0.15	-1.22	12.10
2018	1,000	12.1	13.5	16.1	18.2	-1.00	0.00	-0.15	-1.15	12.10
2019	1,000	12.1	13.5	16.1	17.0	-0.94	0.00	-0.15	-1.09	12.10
2020	1,000	12.1	13.5	16.1	16.0	-0.88	0.00	-0.15	-1.03	12.10
2021	1,000	12.1	13.5	16.1	14.9	-0.82	0.00	-0.15	-0.97	12.10
2022	1,000	12.1	13.5	16.1	14.0	-0.77	0.00	-0.15	-0.92	12.10
2023	1,000	12.1	13.5	16.1	13.0	-0.72	0.00	-0.15	-0.87	12.10
2024	1,000	12.1	13.5	16.1	12.2	-0.67	0.00	-0.15	-0.82	12.10
2025	1,000	12.1	13.5	16.1	11.4	-0.62	0.00	-0.15	-0.77	12.10
2026	1,000	12.1	13.5	16.1	10.6	-0.58	0.00	-0.15	-0.73	12.10
2027	1,000	12.1	13.5	16.1	9.8	-0.54	0.00	-0.15	-0.69	12.10
2028	1,000	12.1	13.5	16.1	9.2	-0.50	0.00	-0.15	-0.65	12.10
2029	1,000	12.1	13.5	16.1	8.5	-0.47	0.00	-0.15	-0.62	12.10
2030	1,000	12.1	13.5	16.1	7.9	-0.43	0.00	-0.15	-0.58	12.10

Figure 2-B: 1000 Warhead Stockpile - Larger Inventory Case

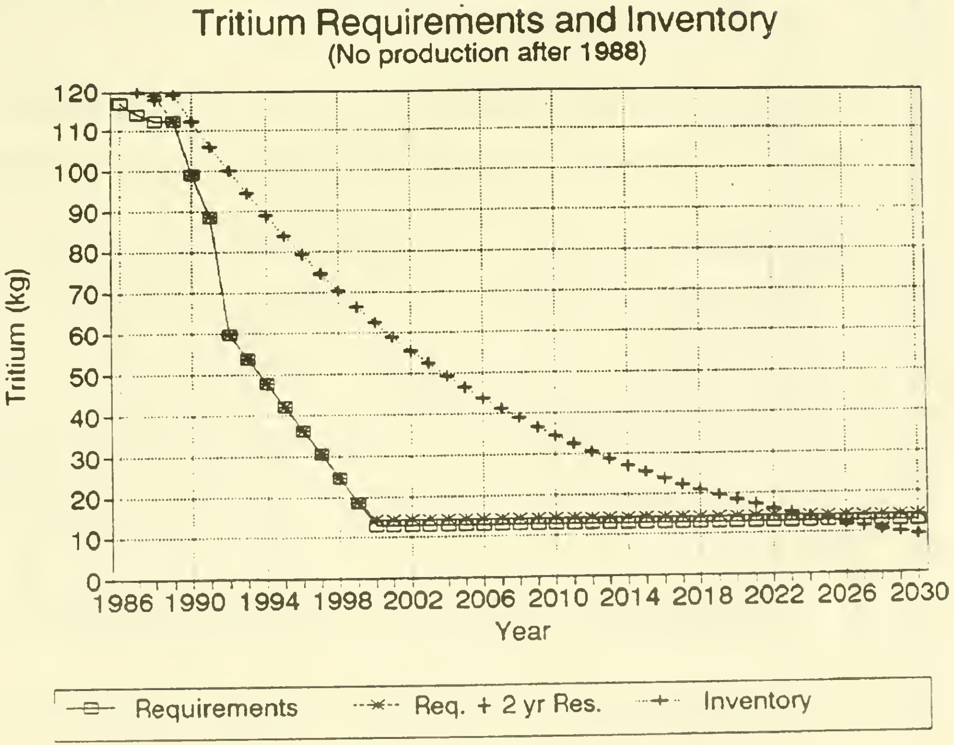


Table 2-B: 1000 Warhead Stockpile - Larger Inventory Case

Begin CY	Warheads	T Req WH+PL (kg)	Req + 2 y Res.	Req + 5 y Res.	T Inv. (kg)	T Inv. Decay (kg)	T Prod. (kg)	T Sales (kg)	Net T Inv. Chang	T/WH (g)
1986	24,000	117.0	125.8	133.1	123.8	-6.80	3.01	-0.18	-3.98	4.87
1987	23,400	114.2	125.8	125.8	119.8	-6.59	4.73	-0.18	-2.03	4.88
1988	23,000	112.3	118.8	118.8	117.8	-6.47	8.04	-0.25	1.32	4.88
1989	23,000	112.3	112.3	112.3	119.1	-6.55	0.00	-0.18	-6.73	4.88
1990	20,942	99.2	99.2	99.2	112.4	-6.18	0.00	-0.18	-6.36	4.74
1991	18,884	88.6	88.6	88.6	106.0	-5.83	0.00	-0.12	-5.95	4.69
1992	11,736	59.7	59.7	59.7	100.1	-5.50	0.00	-0.15	-5.65	5.08
1993	10,394	53.8	53.8	53.8	94.4	-5.19	0.00	-0.15	-5.34	5.18
1994	9,052	47.9	47.9	47.9	89.1	-4.90	0.00	-0.15	-5.05	5.30
1995	7,710	42.1	42.1	42.1	84.0	-4.62	0.00	-0.15	-4.77	5.46
1996	6,368	36.2	36.2	36.2	79.3	-4.36	0.00	-0.15	-4.51	5.69
1997	5,026	30.4	30.4	30.4	74.7	-4.11	0.00	-0.15	-4.26	6.04
1998	3,684	24.5	24.5	24.5	70.5	-3.87	0.00	-0.15	-4.02	6.65
1999	2,342	18.6	18.6	18.6	66.5	-3.65	0.00	-0.15	-3.80	7.96
2000	1,000	12.8	14.3	17.0	62.7	-3.44	0.00	-0.15	-3.59	12.79
2001	1,000	12.8	14.3	17.0	59.1	-3.25	0.00	-0.15	-3.40	12.79
2002	1,000	12.8	14.3	17.0	55.7	-3.06	0.00	-0.15	-3.21	12.79
2003	1,000	12.8	14.3	17.0	52.5	-2.88	0.00	-0.15	-3.03	12.79
2004	1,000	12.8	14.3	17.0	49.4	-2.72	0.00	-0.15	-2.87	12.79
2005	1,000	12.8	14.3	17.0	46.6	-2.56	0.00	-0.15	-2.71	12.79
2006	1,000	12.8	14.3	17.0	43.8	-2.41	0.00	-0.15	-2.56	12.79
2007	1,000	12.8	14.3	17.0	41.3	-2.27	0.00	-0.15	-2.42	12.79
2008	1,000	12.8	14.3	17.0	38.9	-2.14	0.00	-0.15	-2.29	12.79
2009	1,000	12.8	14.3	17.0	36.6	-2.01	0.00	-0.15	-2.16	12.79
2010	1,000	12.8	14.3	17.0	34.4	-1.89	0.00	-0.15	-2.04	12.79
2011	1,000	12.8	14.3	17.0	32.4	-1.78	0.00	-0.15	-1.93	12.79
2012	1,000	12.8	14.3	17.0	30.4	-1.67	0.00	-0.15	-1.82	12.79
2013	1,000	12.8	14.3	17.0	28.6	-1.57	0.00	-0.15	-1.72	12.79
2014	1,000	12.8	14.3	17.0	26.9	-1.48	0.00	-0.15	-1.63	12.79
2015	1,000	12.8	14.3	17.0	25.3	-1.39	0.00	-0.15	-1.54	12.79
2016	1,000	12.8	14.3	17.0	23.7	-1.30	0.00	-0.15	-1.45	12.79
2017	1,000	12.8	14.3	17.0	22.3	-1.22	0.00	-0.15	-1.37	12.79
2018	1,000	12.8	14.3	17.0	20.9	-1.15	0.00	-0.15	-1.30	12.79
2019	1,000	12.8	14.3	17.0	19.6	-1.08	0.00	-0.15	-1.23	12.79
2020	1,000	12.8	14.3	17.0	18.4	-1.01	0.00	-0.15	-1.16	12.79
2021	1,000	12.8	14.3	17.0	17.2	-0.95	0.00	-0.15	-1.10	12.79
2022	1,000	12.8	14.3	17.0	16.1	-0.89	0.00	-0.15	-1.04	12.79
2023	1,000	12.8	14.3	17.0	15.1	-0.83	0.00	-0.15	-0.98	12.79
2024	1,000	12.8	14.3	17.0	14.1	-0.78	0.00	-0.15	-0.93	12.79
2025	1,000	12.8	14.3	17.0	13.2	-0.72	0.00	-0.15	-0.87	12.79
2026	1,000	12.8	14.3	17.0	12.3	-0.68	0.00	-0.15	-0.83	12.79
2027	1,000	12.8	14.3	17.0	11.5	-0.63	0.00	-0.15	-0.78	12.79
2028	1,000	12.8	14.3	17.0	10.7	-0.59	0.00	-0.15	-0.74	12.79
2029	1,000	12.8	14.3	17.0	10.0	-0.55	0.00	-0.15	-0.70	12.79
2030	1,000	12.8	14.3	17.0	9.3	-0.51	0.00	-0.15	-0.66	12.79

Mr. SCHAEFER. We thank the gentleman.

Mr. SCHAEFER. Mr. George Davis, Project Manager, System 80-Plus Deployment, U.S., ABB Combustion Engineering Nuclear Systems.

STATEMENT OF GEORGE DAVIS

Mr. DAVIS. Thank you, Mr. Chairman, members of the subcommittee. I certainly want to express my appreciation for the opportunity to provide testimony to the subcommittee this morning on an issue so important to our national defense, our tritium supply.

Your interest in identifying realistic solutions to a problem that so greatly impacts our national security is to be commended, and I would also like to commend the Speaker's Task Force for the work they did on this very complex issue. Obviously, we agree with their conclusion that the tritium production/plutonium disposition mission should be combined into a single privatized facility.

Our company, ABB Combustion Engineering, has teamed with seven other companies and proposed with the Department of Energy a plan for the deployment of a privatized multipurpose reactor facility to be located on DOE's Savannah River Site. Members of our team include companies like Stone and Webster, Duke Engineering, Raytheon, BNFL, all extremely experienced engineering companies in the nuclear field.

We originally developed an interest in the concept back in late 1992, when Congress first requested that DOE consider the possibility of a reactor that could produce tritium, consume excess weapons plutonium as fuel and generate electricity as a way to offset the cost to the government. We felt that our system 80-Plus advanced light water reactor design was ideally suited for such a mission, because it already had the capability designed in to consume plutonium as a fuel material. We were nearing the end of the review process at the NRC, and we were also getting ready to bid the design in a fixed-price, turnkey proposal overseas.

Therefore, we felt we would be in a unique position to allow the project to proceed quickly and to be privatized.

Our expectations of our advantages were pretty much confirmed when the National Academy of Sciences issued a couple of reports on plutonium disposition in 1994 and again in 1995 that identified our operating System 80 Reactors at Palos Verde and new advanced 80-Plus design as being among the most efficient and least cost reactor model for disposition of excess weapons plutonium.

Our program submitted in March, 1994, called for organizing a consortium that would be set up to privately finance, build, own, and operate a facility. The facility itself would consist of our pair of System 80-Plus reactor units and a fuel manufacturing building. The consortium, on the other hand, would be formed as an exempt wholesale generator, a form of independent power producer that would contract to utilities throughout the southeastern U.S. and contract with the Federal Government to provide two services, the irradiation of tritium-producing targets and disposition of excess weapons grade plutonium. Thus, DOE would have to purchase only the services it needs rather than purchase the entire facility.

We believe, Mr. Chairman, that besides minimizing the governments cost and risk this approach has a distinct advantage that allows the government to avoid the billions of dollars in outlays needed to build new facilities over the next 10 years or so. Instead, the engineering, licensing and construction would all be done with private financing. The government would only pay for fees for services rendered after the facility begins operation.

We envision that the consortium that would own and operate the facility would be comprised primarily of the unregulated subsidiaries of utilities in the southeastern United States, subsidiaries already in IPP business in the southeastern U.S. Thus, we would not be competing against local utilities, we would indirectly have them on the team, and companies such as ourselves and the other engineering companies that initiated the project would only take a minor stake in the ownership consortium.

Unfortunately, as you see in this chart, DOE plans to proceed with separate programs for tritium production and weapons plutonium disposition. If they pursue the accelerator for tritium and a separate program for plutonium, we are likely to see DOE expenditures of at least $3.5 billion over the next 10 years or more for constructing these facilities. After that, the operating costs for both programs will total at least $400 million per year.

On the other hand, with the privatized, multipurpose reactor approach, the only up-front funding required is the $50 million required to organize the private consortium and arrange the contracts, which is something we have said we would be willing to pay back out of future revenues from the facility once it is operational, assuming DOE goes ahead with the project.

When the plant begins operation about 10 years from now, then the government would pay a fixed annual fee of about $78 million, current estimate, for disposition of excess weapons plutonium and a variable fee for tritium production that would vary from zero to $53 million per year to cover the loss in electricity sales.

When the Secretary of Energy recently announced preferred technology, she used the results of the Putnam, Hayes, and Bartlett consulting firm report. Having only been able to obtain a copy of that recently, we have only briefly reviewed it and found a number of what we consider major errors that, when corrected, dramatically change the results. For example, their report incorrectly assumes that utilities will provide irradiation services to DOE for free. There were no costs.

In the case of purchasing an existing reactor, the report incorrectly assumes that the price DOE pays for the plant would be independent of what it will actually cost to operate the plant and the revenue stream it will receive over its remaining life. For example, at the lower end of the bend for the purchase of a current light water reactor, they assumed a plant could be purchased as low as $300 million. Yet looking at the financial assumptions they have for operating costs and revenues, if it only had to produce electricity the plant would actually make a profit, substantial profit, over its life. Under those circumstances, no matter what the investment, it is not realistic they will sell the plant that much below its future value to themselves nor would the public utility commissions let them.

In the case of our 80-Plus design, the large ALWR, they have analyzed the report incorrectly and assume the power level is 250 megawatts below its rated capacity. That obviously cuts out a lot of revenue that would have been generated from electricity sales. It assumes our annual costs will be substantially higher than the current reactors when, in reality, one of the big efforts in the nuclear industries light water reactor program over the last 8 years has been to design the new reactors so they will be much easier to operate and maintain; and, if anything, the operating costs should be lower.

Once we correct the errors in the Putnam, Hayes report, you see the net present value shown in the summary figures look dramatically different. It shows that even at the high end of its uncertainty band the large ALWR would present less cost to the government than low-end estimates for other options.

A couple of days ago, we sent a letter to the Secretary explaining the errors we found in the Putnam, Hayes report; and in our letter we recommended her final record decision include the privatized multipurpose reactor. It is an option to be considered. DOE already plans to spend over $300 million on tritium production over the next few years and a comparable amount of funding on the plutonium program. So adding in the funding for the privatized multipurpose reactor to be put together seems like it should be manageable within that size of a budget.

In closing, Mr. Chairman, thank you and members of the subcommittee for the opportunity to speak this morning. We certainly appreciate your efforts on this. I will be glad to answer questions after Mr. Miller.

[The prepared statement of George A. Davis follows:]

PREPARED STATEMENT OF GEORGE A. DAVIS, PROJECT MANAGER, SYSTEM 80+ DEPLOYMENT, U.S. ABB COMBUSTION ENGINEERING NUCLEAR SYSTEMS

ABB Combustion Engineering, has teamed with seven other companies and proposed a plan to the Department of Energy for the deployment of a privatized multipurpose reactor facility on DOE's Savannah River Site. Our team includes several other large engineering companies, including Stone & Webster Engineering Corporation, Duke Engineering & Services, Raytheon Engineers & Constructors, and BNFL, Inc.

We originally developed an interest in this concept in late 1992, when Congress requested that DOE consider the possibility of a multipurpose reactor that could (1) produce tritium, (2) consume excess weapons plutonium as fuel, and (3) generate electricity, as a way to offset the government's costs. We felt that our System 80+ Advanced Light Water Reactor design was ideally suited for such a mission—especially since the design already included features needed for consumption of plutonium fuel. Since we were nearing the end the review process at the Nuclear Regulatory Commission and were about to begin bidding the design in a fixed price turnkey proposal overseas, we felt that we would also be in a unique position to allow the project to proceed quickly and to be privatized. Our expectations were confirmed when the National Academy of Sciences' two reports on plutonium disposition identified our operating System 80 reactors at Palo Verde and our new System 80+ design as the most efficient and least-cost reactor models available for disposition of excess weapons plutonium.

What we submitted to the Department in March of 1994 was a Program Plan for organizing a consortium that would privately finance, build, own, and operate the multipurpose reactor facility on DOE's Savannah River Site. The facility would consist of a pair of our System 80+ reactor units and a fuel manufacturing building. The consortium would be formed as an Exempt Wholesale Generator, a form of Independent Power Producer, that would contract to sell electricity to utilities throughout the Southeastern U.S. and contract with DOE to provide two services: irradiation of tritium-producing targets and disposition of excess weapons plutonium, by consuming it as fuel. Thus, DOE would only have to purchase the services that it needs, rather than purchase and operate the entire facility. Besides minimizing the government's costs, this has the distinct advantage that it allows the government to avoid billions of dollars in outlays to build new facilities for production of tritium and disposition of plutonium over the next ten years. Instead, the engineering, licensing, and construction would be done with private financing. DOE would then begin paying fees for services rendered, after the facility goes operational.

In our Plan, we envision that the consortium that would own and operate the facility would be comprised primarily of the unregulated subsidiaries of utilities in the Southeastern U.S.—subsidiaries that are already in the IPP business. Thus, we would not be competing against the local utilities. They would, indirectly, be on the team. We envision that ABB and the other engineering companies that initiated the project would have only a minor stake in the ownership consortium.

It did not take us long to determine that Savannah River Site was the ideal location for such a facility. Our market analysis showed that the Southeastern United States will be the first region of the country to need new baseload electric generation capacity, right after the turn of the century. Besides the need for power, the region is expected to see relatively high market prices for electricity—thus, maximizing the revenue stream. It was also deemed most desirable to locate the facility on a government controlled site, for security purposes. Savannah River Site was considered ideal because of its size (almost the entire emergency planning zone fits in the site boundary) and because of its existing infrastructure for tritium handling, plutonium handling, and security. Furthermore, there is strong support for nuclear energy in the local community and at the state level. Since the facility would be licensed by the NRC and undergo public hearings prior to its construction, we felt that the local and state support would be essential.

Based on our initial cost estimates to build and operate the multipurpose reactor facility and our market analysis of future electricity prices in the Southeastern U.S., we estimate that the electricity sales would cover about 90% of the costs. The remainder would be charged to DOE for the services that it receives. Since the plutonium disposition mission can be well defined up-front, before DOE has to make contractual commitments, we have proposed that DOE pay a fixed annual fee for disposition of excess weapons plutonium—currently estimated at $78 million per year in constant 1995 dollars.

Since the long term needs for tritium production are not as easily defined, and may be subject to change, we proposed that DOE pay a variable annual fee for irradiating targets. The fee would cover lost electricity sales, if any, when tritium is being produced. To produce tritium at the rate of 3/8 of the 1988 goal (DOE's current upper limit estimate), we estimate the variable fee would be $53 million per year. However, if no tritium were being produced, then no fee would be paid. This gives DOE the maximum flexibility in contracting for the service. Compared to the alternative of DOE building a new dedicated facility for tritium (e.g., the accelerator), our approach avoids the risk that billions of dollars might be spent to build a facility and then later find that it is no longer needed, or is oversized.

Our Plan proposes that the initial three year effort, costing $50 million, to organize the project and establish power sales agreements be paid by DOE. At the end of that period, there would be a financial closing and the privatized project would then proceed, without the need for DOE funding until the facility went operational and services were being provided. We would pay back the $50 million, if DOE agrees to go forward with implementation of the project. In reality, no up-front government funding would be required if DOE were in a position to commit to go forward with the project before the project organization phase was started. Unfortunately, this is a Catch 22 situation, since DOE would not know the details of what it is committing to, until the project is organized. We feel that the initial DOE investment would be very worthwhile, considering that DOE already plans to spend about ten times this amount on the tritium production and plutonium disposition programs.

On September 29 of this year, we submitted an Alternate Plan to DOE—to address the Department's concerns about the difficulty in establishing long term power sales agreements with utilities, during a time of great upheaval in the power industry. The Alternate Plan focuses upon the use of a single System 80+ reactor, which dramatically reduces the amount of private capital that must be raised and cuts in half the amount of electricity that must be sold. The Alternate Plan also uses a greatly simplified method of selling electricity from the plant, by using a power marketer and selling at the market prices for electricity, when it is generated. This will assure that the electricity can be sold; however, the risks concerning future revenues from electricity would then have to be shared by the consortium and the government. Fortunately, the government's risks can be shown to still be less than with its other options for tritium production and plutonium disposition. The simplified Alternate Plan would also cut the project organization phase to only a year and reduce funding needs to $18 million.

Although we still believe that our original March 1994 Program Plan is achievable and in the government's best interest, we feel that the Alternate Plan represents a fall-back scenario that assures a successful outcome.

When compared to the accelerator option for tritium production, our privatized multipurpose reactor offers several advantages:

1. By privatizing the tritium mission, DOE avoids the need to spend several billions of dollars over the next ten to fifteen years to research, engineer, and construct a new facility.

2. No research and development on the reactor design is required. It is ready to proceed immediately. Since the System 80+ design already has the capability to consume plutonium fuel, it does not require any modifications for disposition of excess weapons plutonium. As we do when any change is made to the fuel assembly design, we would plan to manufacture and irradiate demonstration fuel assemblies in an existing reactor. As for the tritium-producing targets that would be loaded into the fuel assemblies, DOE will already be completing the qualification program for them, as part of the future effort on the existing reactor option. These two demonstration efforts are insignificant, when compared to the research program planned for the accelerator.

3. Any risk in NRC licensing of the reactor plant will be substantially smaller than the technical risks involved in developing the accelerator. The System 80+ design has already been reviewed and approved by the NRC. Certification will be issued by mid-1996. NRC licensing of the plant at Savannah River Site will be greatly simplified, since NRC now has a one-step licensing process that completes the NRC review and hearings prior to starting construction. This will avoid the messy delays that held up operation of some of the current reactors after they were built. By locating the unit on a government site, NRC approval of the site and the emergency planning should be greatly simplified.

4. Because the System 80+ design is already being offered overseas in fixed-price turnkey bids, private industry (instead of government) can shoulder the bulk of the risks from cost overruns. Considering that the accelerator is still in the pre-conceptual design phase, the government will certainly be exposed to substantial cost increases for the accelerator, as the design is developed and constructed.

5. Because the annual fee for tritium production in the privatized multipurpose reactor would be variable, DOE would only pay for tritium services if and when it needs them. On the other hand, a facility that can only produce tritium will have substantial fixed costs that cannot be avoided. Furthermore, if the tritium mission were to change significantly over the years, then the tritium-only facility may have billions of dollars invested to build a facility that is no longer needed, or is oversized.

6. Besides fulfilling the tritium mission, the privatized multipurpose reactor would solve another DOE problem—the disposition of excess weapons plutonium. If kept as a separate program, DOE will be announcing its decision next year to proceed with another multi-billion dollar project for disposing of the plutonium. One of the options certain to be announced will be the consumption of the plutonium as fuel in reactors.

When compared to the current-reactor option, our privatized multipurpose reactor offers several advantages:

1. Since the multipurpose reactor would be located on the government controlled Savannah River Site, DOE avoids the security and transportation costs of converting a privately owned site.

2. Reliability of a long term tritium source will be assured by using a brand new facility for 40 or more years of operation. By the time tritium begins in an existing reactor, the plant will be in the latter half of its design life and will require a life-extension program to fulfill the 40 year tritium production mission.

3. The multipurpose reactor would be constructed on a government site and its government mission of tritium production will be publicly declared prior to starting the project. There is no appearance of duplicity. On the other hand, conversion of a nuclear plant built for peaceful purposes (electricity generation) and then later converted to tritium production for weapons purposes may raise policy objections both domestically and internationally. Although there are no policies or treaties prohibiting such a conversion, it seems to fly more in the face of nonproliferation goals to change a nuclear plant's mission after it has already been built and operated.

4. A new nuclear plant—co-located on a government site with existing tritium handling facilities, using the latest technology, with improved safety standards, improved operability and maintainability, and a longer remaining design life—should

be economically competitive with an existing nuclear plant. It also avoids the legal and economic uncertainties of a utility trying to sell irradiation services or sell the plant itself.

When the Secretary of Energy announced her preferred technologies for tritium production on October 10 of this year, she used the results of a cost analysis performed by a Washington consulting firm, Putnam, Hayes, and Bartlett (PHB). No explanation was given for why DOE relied upon the PHB cost analysis, instead of the cost analysis performed by DOE's contractor for the Tritium PEIS and decision process: Fluor Daniel. In any event, the PHB report showed the existing reactor options to be the least costs to DOE and the accelerator to be among the highest cost options. The Secretary announced a dual track approach to (1) pursue the existing reactor options because they are the least expensive options, and (2) the accelerator because it may have less environmental impact.

Having only recently obtained a copy of the PHB report, we have briefly reviewed it and found a number of major errors that, when corrected, dramatically change the results. For example, the PHB report incorrectly assumes that utilities will provide irradiation services to DOE for free. It doesn't even include funding the utilities for the expenses that they will incur. When it comes to the purchase of an existing reactor, the PHB report incorrectly assumes that the price DOE pays for the plant is independent of the costs to operate it and the revenues that it can be expected to produce from electricity sales. In their generic example for the optimistic scenario, a plant could be purchased for $300 million—even though it would be projected to operate at a substantial profit over its remaining life. No matter what the utility's stranded investment, it is not realistic to assume that they will sell the plant below its future value—nor that their public utility commission will let them. In the case of our System 80+ design, the PHB report incorrectly assumes the power level to be 250 Mwe below its rated capacity, thus substantially reducing the revenues from electricity sales. The PHB report also incorrectly assumes our annual operating costs to be substantially higher than for current reactors, when, in reality, one of the major objectives of the nuclear industry's Advanced Light Water Reactor program has been to design the new plants so that operating costs will be lower.

After correcting the errors that we found in the PHB report, the report's summary figure of the Net Present Value Costs to the government looks dramatically different. The corrected figure shows that, even at the high end of its uncertainty band, the Large ALWR (based on our System 80+ design) would present less cost to the government than the low-end estimates for all of the other options—including existing reactors.

On November 13, we sent a letter to the Secretary that explains the errors found in the PHB report, along with the revised summary figure showing the cost impacts of those corrections. We also noted that DOE's belief that the accelerator may have less environmental impact than a new nuclear plant is based upon what we consider a major shortcoming of the final Programmatic Environmental Impact Statement. The document still does not reflect that the electricity-producing reactor options offset the need to build and operate an equivalent capacity of fossil-fueled power plants and that the accelerator will require that new fossil-fueled power plants be built and operated to provide electricity for it. When these benefits and impacts are included, the reactor options will result in less environmental impact than the accelerator.

In our letter to the Secretary, we recommended that her final Record of Decision include the privatized multipurpose reactor as an option for tritium production. DOE already plans to spend $323 million on the tritium program over the next three years, before selecting the final technology to use. Significant funding will also be devoted to the plutonium disposition program. The costs for the privatized multipurpose reactor should have a negligible effect on their budgets.

We continue to believe that our proposed approach for a privatized multipurpose reactor will result in providing DOE with the most economical and reliable source of tritium, while solving another DOE problem—plutonium disposition.

Mr. SCHAEFER. The subcommittee thanks the gentleman.

Mr. James Miller, Senior Vice President and Corporate Counsel, Southern Nuclear Operating Company.

STATEMENT OF JAMES H. MILLER, III

Mr. MILLER. Thank you, Mr. Chairman.

You know, you sit here and if it turns out to be your lot in life that you are the last witness on the last panel it occurs to you that maybe if I spoke just from a perspective that I have had, with the benefit of hearing other witnesses and in some cases reading their testimony, it would be better. I, too, have a formal statement that I was going to read, but maybe I can forgo that with the Chair's indulgence and give you something of a view of a commercial reactor and how it would apply in all of this.

You know from the testimony that with me is Fred Williams. He is with Georgia Power Company. They are the principal owner of the two Georgia power reactors.

My company operates the Farley reactor in the State of Alabama. We are principally a nuclear operating company. We are scientists and engineers. And when this issue was created and when it came to our attention we did not do anything materially different than what this panel is doing. We sat down and said, if you were handed this job, if this was your task, what would you do? Of the options you see out there, how would you go about making the decisions?

The first thing we said is, what scientists and engineers do, is it technically feasible? You will see from our testimony, yes, we believe it is technically feasible to make tritium in a commercial reactor and do so with really not that many changes that have to go on. There are studies that have to be done. We are aware there have been some done in the past and haven't been fully completed, and we would like to participate in more of those, but we can say to this panel why we think it is technically feasible.

What are the barriers? You have heard today about licensing issues. There is no reason for me to go back over that for you. But we do see some regulatory issues of consideration that would come up that the Congress may wish to deal with or that we may be able to work our way through, but we do not see them as barriers. They are certainly something that good men and women of good intentions can work their way through.

What are the business structures? That is a point I have heard talk about a fair amount today and was one of the key drivers for us. What makes good business sense? As we sit here in the day and time that we all know we are here on budget-type issues, that is the principal consideration for us.

Public utilities are, in large part, accounting and engineering functions, and they are comfortable with the phrase cost of service and what makes a prudent decision. We looked at that and we said, clearly, somewhere in the mix a detailed evaluation should occur about an existing light water reactor.

There are the possible, in big-picture terms, business structures, the purchase of the reactor that brings with it some pluses and minuses or a fee-for-radiation services. If you add to that the possibility of disposing of plutonium in a reactor, then really the existing commercial reactor becomes just a classic case to go out and examine closely and use in your decision.

In a sense, actually I didn't say that right. Let me say it more emphatically. We are a triple-play reactor. Currently, there is electric generation from the existing commercial reactors. It is sold into the marketplace.

We are not here as a marketing opportunity for us. We are not here on a series of—we have people come to us all the time with generation plans. And if this occurs and if the load is there and if you get financing and if you get it constructed and get over the construction risk and the operating experience, commercial reactors have done that. I mean, we are—we have accomplished that risk. We operate well.

You will see in our testimony as this committee goes through its decision process some of the things we suggest you consider strongly: selection of a new reactor, relatively new, licensed recently, with good management, good operating experience, big. We are not exactly in tune with how much tritium production, but you would think you would want a big reactor and one that has the capability of burning MOX fuel. All of those are very important considerations, and there are reactors right now that can participate in that.

As I sort of sit here and take in what I have heard this morning, we would ask this committee to know that the Southern Electric System is more than willing to work with the committee, more than willing to discuss these issues and in much greater detail, if the committee so desires, or with the Department of Energy if they so desire. We will ask you just to give strong consideration to the existing reactor. It is out there. They are, as you have heard from Mr. Curtis, available for license extension; and we are, in that sense, ready to go to work early; and we can stay late.

We appreciate your time. Don't hesitate to ask us any questions if you have any. Thank you.

[The prepared statement of James H. Miller, III follows:]

PREPARED STATEMENT OF JAMES H. MILLER, III, SENIOR VICE PRESIDENT AND CORPORATE COUNSEL, SOUTHERN NUCLEAR OPERATING COMPANY, INC. AND FRED D. WILLIAMS, SENIOR VICE PRESIDENT, GEORGIA POWER COMPANY

Mr. Chairman: Thank you for the opportunity to appear before the House Commerce Subcommittee on Energy and Power to present the views of The Southern Company on the important subject of the renewal of the nation's supply of tritium. My name is James H. Miller, III. I am Senior Vice President and Corporate Counsel of Southern Nuclear Operating Company Inc., a wholly owned subsidiary of The Southern Company. With me today is Fred D. Williams, a Senior Vice President of Georgia Power. Together we will sponsor this testimony and respond to your questions on this important national issue.

The Southern Company is a registered public utility holding company with its principal office in Atlanta, Georgia. In addition to Southern Nuclear, it is the parent firm of five electric utilities: Alabama Power Company, Georgia Power Company, Gulf Power Company, Mississippi Power Company, and Savannah Electric and Power Company, as well as Southern Company Services, Inc. Southern Electric International, Southern Development and Investment Group, and Southern Communications Services. Its common stock is one of the most widely held utility stocks in the country.[1]

Southern Nuclear is the nuclear operating company and service company for The Southern Company system. The company's only function is to provide operating, technical and support services to Southern's nuclear power plants. Those plants are the Joseph M. Farley Nuclear Plant, owned by Alabama Power Company, and the Edwin I. Hatch Nuclear Plant and Alvin W. Vogtle Electric Generating Plant, owned, in part, by Georgia Power Company.[2] Currently, Southern Nuclear is the operating licensee of Plant Farley and provides technical and support services for Plants Hatch and Vogtle. Regulatory approval is pending for Southern Nuclear to become the operating licensee of Plants Hatch and Vogtle.

The Southern Company has a long-standing commitment to nuclear power. We are gratified that our plants have been recognized by nuclear rating organizations and the Nuclear Regulatory Commission as some of the safest and most efficiently operated in the industry. For example, Plant Hatch has been operating for over twenty (20) years and has enjoyed considerable success in its nuclear operations. Plant Farley's Unit 2 was recently ranked fifth among U.S. units in efficiency based upon gross capacity factor. The newest of our plants, Plant Vogtle, which is located near Augusta, Georgia on the banks of the Savannah River, is recognized worldwide for its high capacity factors and short refueling outages. The Utility Data Institute recently analyzed production costs and ranked Plant Vogtle as one of the top three performers in the United States. In 1995, Vogtle Unit 1 broke the Westinghouse world record for the shortest refueling outage for plants of its type. The people of Plant Vogtle have been honored by the Institute of Nuclear Power Operations (INPO), as signified by receiving the Institute's prestigious "Award of Excellence." Important also is the commitment of our employees to their profession and the industry. Our officers and employees hold leadership positions in a variety of industry organizations and take seriously the responsibility of an NRC licensee.

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[1] A map illustrating the principal service territories of The Southern Company and the location of its nuclear plants is attached as Exhibit 1 to this testimony.

[2] A detailed description of the three nuclear plants is attached as Exhibit 2 to this testimony.

The Southern Company appreciates the Subcommittee's invitation to provide testimony concerning the existing commercial reactor alternative for reinitiating the production of tritium to support the nation's defense program requirements. We understand that Congress and the Administration agree on the need to replenish the nation's supply of tritium and that a number of production options are under consideration. Among these are the construction of a new linear accelerator, the construction of a new light water nuclear reactor, and the use of a commercial nuclear power reactor(s) currently in operation in the United States. The testimony presented by the previous witnesses regarding the attributes of each of these options has been instructive and illustrates the wide range of opinions on this issue. Our purpose in this hearing is neither to promote nor criticize these options, nor to advocate any policy position regarding the use of commercial reactors for tritium production—that is the prerogative of the Congress and the President. We will, instead, provide this Subcommittee with an objective analysis of the attributes of using an existing commercial nuclear reactor for tritium production, together with an identification of some of the most pertinent issues which the Congress may face with this option. In the past few months we have had similar discussions with responsible authorities, including the Speaker's Task Force on Nuclear Cleanup and Tritium Production and the Department of Energy.

TECHNICAL SUMMARY

1. Technical Feasibility

Past experience with tritium production is based mostly on heavy water reactor technology. Although this experience will prove helpful, the operating parameters (temperature, pressure, and cycle length) involved in light water reactor technology are significantly different and require additional design and testing of new lithium targets.

The production of tritium in a commercial light water nuclear reactor, conceptually, is a straightforward matter with no identified impact upon the safety of reactor operation, but it has not been done before. As is illustrated in Exhibit 3, nuclear reactors produce electricity with heat created by uranium fission which, in turn, creates steam for the turbine and a generator. Reactors are started up and shut down by the use of control rods, which absorb neutrons and therefore control the chain reaction. When the control rods are withdrawn from the reactor's core, more neutrons are available to cause atoms to split, or fission, and a self-sustaining nuclear chain reaction can be achieved. When the control rods are fully reinserted, the number of neutrons declines, reactivity is reduced, and the reaction is minimized. A typical large Westinghouse pressurized water reactor (PWR) contains 193 fuel assemblies. Within each fuel assembly, there are 24 thimble tubes which provide locations for the control rods to be inserted. Typically, 53 of the 193 fuel assemblies will have control rods.

Periodically, a reactor must be shut down and a portion of its depleted fuel assemblies replaced with new fuel assemblies. Operation from one refueling to the next refueling is referred to as a fuel cycle. In order to accommodate fuel cycles of sufficient duration to achieve optimal cost and operating efficiency, uranium in excess of that needed to achieve a self-sustained chain reaction is loaded into the reactor core. A typical PWR, such as Southern's Plants Vogtle and Farley, controls the excess uranium fuel that must be loaded into the reactor core at the beginning of each new fuel cycle by adding soluble boron to the reactor coolant system and by the insertion of rods containing boron, called burnable absorbers, into selected fuel assemblies. Boron is a material that has a high probability of absorbing neutrons and thus removes them from the chain reaction. Normally about one-third of the 140 fuel assemblies which do not contain control rods contain burnable absorber rods.

Tritium (H^3) is produced when a neutron is absorbed by the nucleus of a lithium (Li) atom. This process is illustrated in Exhibit 4. Tritium can, therefore, easily be produced by placing a material containing lithium in any nuclear reactor where it will be irradiated with neutrons. Like boron, lithium has a good probability of absorbing neutrons and thus can serve as a replacement for it as a neutron absorber in a commercial PWR nuclear reactor. As illustrated in Exhibit 5, material containing lithium can be fabricated into rods, called targets, and inserted into fuel assemblies in the same manner as burnable absorbers. Approximately 140 fuel assemblies are available for this purpose. No mechanical design changes to either the fuel assemblies or the reactor would be required. At the end of each fuel cycle, the irradiated lithium targets (now containing tritium) would be removed from the fuel assemblies and could be replaced with new targets. The irradiated targets would then be sent to a facility which would extract the tritium from the targets for processing. We understand that the most likely location of such a facility is the Savannah River Site.

Government funded research and testing of lithium targets to determine the optimum design for use in light water PWRs was initiated some years ago, but has not been completed. Completing this research will provide information concerning the fuel-target mixture which provides the optimum production of electricity and tritium at the most economical cost. In order to ensure this technology is a timely option, Congress needs to continue funding support for final design and testing.

2. Optimal Commercial Reactor Characteristics

In order to realize the full extent of the technical and economic benefits of the use of a commercial nuclear reactor for production of tritium, it is necessary to select a reactor with certain design, operating and physical characteristics. Fortunately, these characteristics can be evaluated by objective means, and candidate reactors exhibiting these attributes exist in the United States. The ultimate success of the production of tritium in a commercial reactor will depend upon the selection of a reactor which provides the optimum combination of all of these characteristics.

a. Recently Licensed Reactor—Selection of a recently licensed reactor would provide a relatively more modern design and more recent construction, resulting in lower maintenance and repair costs and a longer period over which the government's investment in tritium production could be recovered. Such a reactor would also not require new construction, avoiding the uncertainties inherent in the construction and licensing of a new nuclear plant as well as enabling the commencement of tritium production in a more timely manner. Moreover, use of an existing reactor would avoid the environmental costs attendant to the construction of a new facility, which is estimated to require up to 560 acres for plant and infrastructure. Other "unavoidable" environmental impacts, such as loss of habitat in the disturbed area, loss of wetlands, the visual impact of the physical structure and vapor plumes, and the construction of additional miles of transmission lines would also be avoided by the use of an existing reactor. Finally, security and state and local emergency planning organizations already in place at recently licensed reactors will require little modification to accommodate the production of tritium.

b. Proven Management—An experienced management team with an outstanding operating record is also critical to the beneficial use of a commercial nuclear reactor for tritium production. The primary characteristics of an appropriate management culture are an outstanding safety record, a high capacity factor and low production costs. Low management turnover and years of working together as a team are also desirable. Both safety and efficiency can be evaluated by objective means as described below.

A management culture that emphasizes safe and efficient operation can be determined by the results of regular evaluations conducted by INPO and the results of regular NRC inspections, such as the "Systematic Assessments of Licensee Performance." A nuclear reactor's operating efficiency is demonstrated by the maintenance of high capacity factors, short refueling outages and infrequent unscheduled outages. Such factors impact directly the production costs, which are analyzed by organizations such as the Utility Data Institute. These operating characteristics illustrate the impact that quality of nuclear plant management would have on the reliability of and ultimate cost to the federal government of tritium production in such a facility.

c. Size and Location—Sufficient operating capacity to enable a single site to satisfy all of the nation's tritium production requirements and physical location near the site of the facility designated for tritium processing are important to the achievement of the goals of the tritium program. A two-unit site with large, high-power level reactors should eliminate the necessity of multiple generating sites and allow for maximum flexibility of production. A single site located near the federal tritium processing facility will limit the number of safety, security and environmental risks created by the transportation of tritium from the reactor to the processing facility. If necessary, of course, tritium can be transported safely over the nation's highways, but a location near the extraction facility simply minimizes the potential impact of this issue.

d. Mixed Oxide Fuel Capability—Finally, we are aware that the Speaker's Task Force on Nuclear Cleanup and Tritium Production has recommended that "the plutonium disposition mission, and the DOE organization responsible for it, should be combined with the tritium production program—if doing so will reduce the combined costs of the two programs, while not detracting from the objective of assuring a reliable tritium supply." In order to accommodate the disposition of surplus weapons grade plutonium, in addition to tritium production and electric generation, it would be beneficial for any reactor selected for the production of tritium to also be able to consume Mixed Oxide (MOX) fuel, which is composed of a blend of uranium and plutonium. Commercial reactors that can function as "triple-play reactors," meaning that they have the capability to generate electricity, produce tritium and consume fuel containing plutonium, are currently licensed and operating in the United States.

FINANCIAL CONSIDERATIONS

There are, of course, many possible financial arrangements that can be made to implement a decision to utilize a commercial reactor for tritium production. These arrangements are limited only by the imagination of the participants, but would probably fall into two general categories: 1. the federal government purchases the reactor outright; or 2. the federal government executes a fee-based contract for tritium production services with the owner/operator of a reactor. We will briefly address the attributes of each of these options below:

1. Federal Government Purchases the Reactor

If the United States purchases an existing commercial nuclear reactor, it will not only own its tritium production capacity, it will own the electrical generation of the facility and avoid some of the issues discussed below relative to the use of a commercial nuclear reactor for military purposes. The safe and efficient operation of the reactor would most effectively be accomplished by the government contracting with the seller to operate the reactor for a fee. It is also possible that the seller would contract to purchase the electrical generation of the reactor. This combination would assure the government of the most reliable and cost-effective use of the reactor.

The purchase price of a commercial reactor will depend upon many variables, such as its age, size, operating history, etc. However, it is likely that the cost of any existing commercial reactor will undoubtedly be less than the cost of constructing a new reactor. In addition, by utilizing the existing operating management, a government-owned facility could be operated at a lower embedded cost of production than a commercial facility simply because of the government's lower cost of capital.

2. Contract Tritium Production Services

The federal government might also satisfy its tritium production requirements by contracting with a commercial reactor to produce tritium during its normal operations. This option has the advantages of transactional simplicity and lower initial capital outlay. As discussed below, however, this option involves several regulatory issues and would require a more thorough analysis of United States policy concerning the use of civilian nuclear reactors for military purposes than would the production of tritium in a government-owned facility.

Again, given our present level of understanding of this technology, it is difficult to predict the optimum tritium production/electrical generating mix and, for that reason, the ultimate cost to the government of this option. Notwithstanding these uncertainties, however, contracting with a nuclear utility for tritium production services is an option that merits careful evaluation.

LEGAL AND REGULATORY ISSUES

As mentioned at the beginning of our testimony, the use of a commercial nuclear reactor for the production of tritium for military application will necessarily involve an evaluation of this country's nuclear policy. In the past, the United States policy has been to separate the commercial use of atomic power from military applications. This separation of function is embodied in several provisions of the Atomic Energy Act. Although production of substantial quantities of tritium in a commercial nuclear reactor would probably not contravene any provision of federal law, such an initiative will focus attention on the appropriate uses of commercial nuclear reactors, and a reevaluation of United States policy and law might be appropriate.

The use of a reactor constructed for the purpose of generating electricity for the dual function of tritium production may raise regulatory issues which could require some amendment to or supplementation of federal statutes and regulations which currently apply to commercial nuclear power reactors. Although these issues likely would not implicate the NRC's role in safeguarding public health and safety, a policy decision to employ a commercial nuclear power reactor as a source of tritium production would require some review and possible revision of NRC rules to address this unique, and previously non-existent, situation.

The use of an existing commercial reactor for tritium production might also require a careful review of international agreements and treaties between the United States and other countries regarding the use of commercial nuclear reactors. Certain treaties and agreements, for instance, limit the uses of commercial reactor fuel to non-military purposes. This limitation is also incorporated in many fuel contracts between nuclear utilities and their fuel suppliers and would require careful analysis to determine whether they should be clarified in connection with the production of tritium for military applications.

None of the legal or regulatory issues referred to here should necessarily foreclose the use of a commercial reactor for tritium production or suggest that such use is not consistent with the protection of public health and safety. Neither would such use be at odds with the clear purpose of legislative, regulatory and contractual prohibition of the production of nuclear weapons by civilian nuclear reactors. We only mention these issues as potential areas of uncertainty, where some legislative or regulatory clarification may be appropriate. Of course, we will be happy to work with this Subcommittee to assist in clarifying these points should you so desire.

CONCLUSION

We appreciate the opportunity to appear before the Subcommittee today and express our views about this important issue. We encourage this Subcommittee to continue its pursuit and investigation of this important national issue. We will be happy to answer any questions that you may have.

Exhibit 1

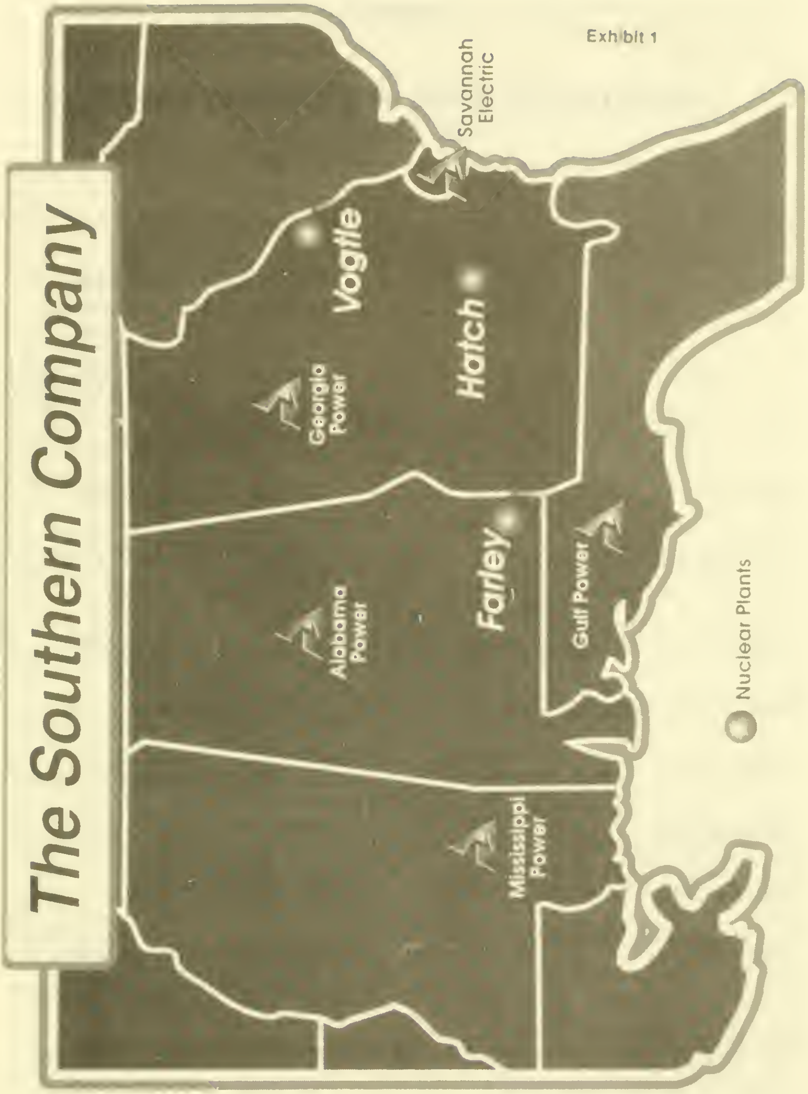

The Southern Company
Savannah Electric
Georgia Power
Vogtle
Hatch
Alabama Power
Farley
Gulf Power
Mississippi Power
Nuclear Plants

Exhibit 2

VOGTLE ELECTRIC GENERATING PLANT FACT SHEET

Plant Name:	**Vogtle Unit 1 and 2**
Owners:	Jointly owned by Georgia Power (45.7%), Oglethorpe Power Corporation (30%), Municipal Electric Authority of Georgia (22.7%), City of Dalton (1.6%)
Operator:	Georgia Power Company
Site Location/Address:	26 miles southeast of Augusta, Georgia
Facility Licensed Thermal Power Limit:	(Ref: License) 3565 MWt
Main Turbine Generator Rated Output:	1223 Mwe (Gross)
PWR Type:	4-loop
NSSS Vendor:	Westinghouse
Turbine Generator:	General Electric
Arch. Engr.:	Southern Co. Services Inc. /Bechtel Power Company
Constructor:	Georgia Power Company
Date of Commercial Operation, Unit 1:	6/01/87
Date of Commercial Operation, Unit 2:	5/20/89

EDWIN I. HATCH FACT SHEET

Plant Name:	**Hatch Unit 1 and 2**
Owners:	Jointly owned by Georgia Power Company (50.1%), Oglethorpe Power Corporation (30%), Municipal Electrical Authority of Georgia (17.7%), and the City of Dalton (2.2%)
Operator:	Georgia Power Company
Site Location/Address:	11 miles north of Baxley, Georgia
Facility Licensed Thermal Power Limit:	2436 Mwt
Main Turbine Generator Rated Output:	786 Mwe (net)
Reactor Type:	BWR 4
NSSS Vendor:	General Electric
Turbine Generator:	General Electric
Arch. Engr.:	Southern Co. Services Inc. /Bechtel Power Company
Constructor:	Southern Co. Services, Inc.
Date of Commercial Operation, Unit 1:	12/31/74
Date of Commercial Operation, Unit 2:	9/05/79

JOSEPH M. FARLEY FACT SHEET

Plant Name:	**Farley Unit 1 and 2**
Owner:	Alabama Power Company
Operator:	Southern Nuclear Operating Company
Site Location/Address:	16.5 miles from Dothan, Alabama
Facility Licensed Thermal Power Limit:	(Ref: License) 2652 Mwt
Main Turbine Generator Rated Output:	861 Mwe
PWR Type:	3-loop
NSSS Vendor:	Westinghouse
Turbine Generator:	Westinghouse
Arch. Engr.:	Southern Co. Services Inc. /Bechtel Power Company
Constructor:	Flour Constructors International, Inc.
Date of Commercial Operation, Unit 1:	12/01/77
Date of Commercial Operation, Unit 2:	7/30/81

Exhibit 3

Pressurized Water Reactor (PWR)

Water in the Reactor Coolant System is heated by the fission process. When atoms are split, heat is released. The reactor coolant does not boil because it is kept under high pressure. The heat is transferred by the reactor coolant to the steam generator where it causes the feedwater in the steam generators to boil and create steam. The steam passes to the turbine and turns the turbine, which turns the generator to produce electricity.

The used steam is condensed and pumped back to the steam generator to be reused. Water used to cool and condense the steam is then cooled by cooling towers outside the plant. After the reactor coolant transfers its heat to the feedwater in the steam generator, it flows back to the reactor to cool the reactor and transfer heat created by the fission process. Control rods help control the fission process.

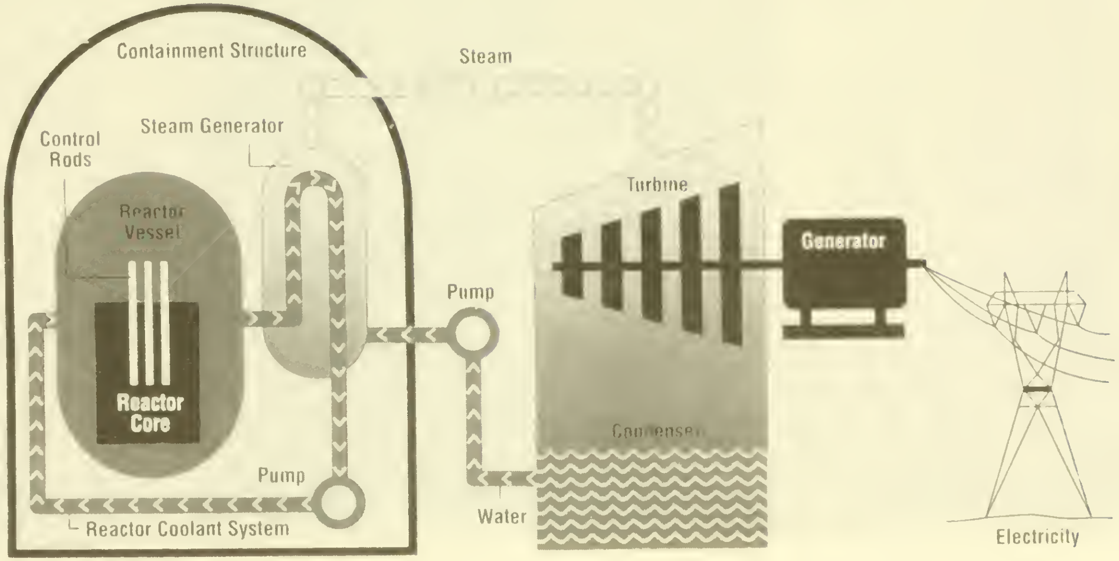


Exhibit 4

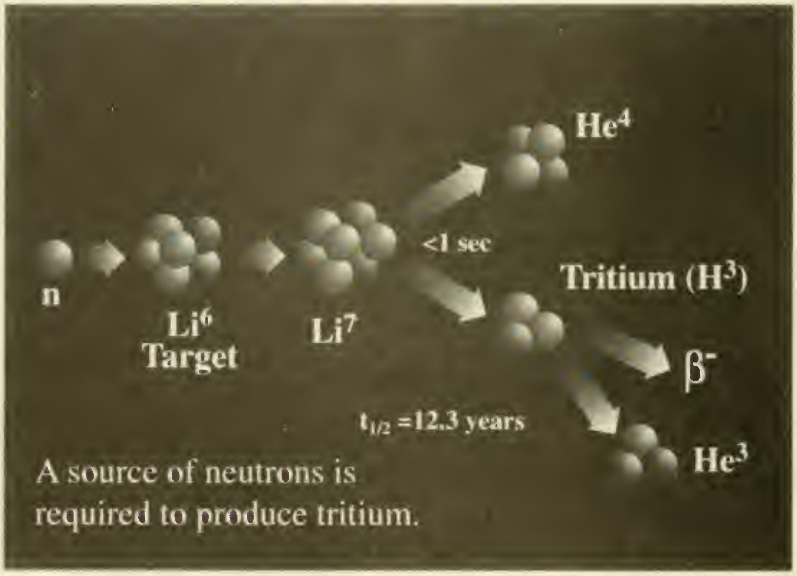
Tritium Production

Theory:

- Lithium (Li^6) neutron capture yields helium-3 (He^3) and tritium (H^3)

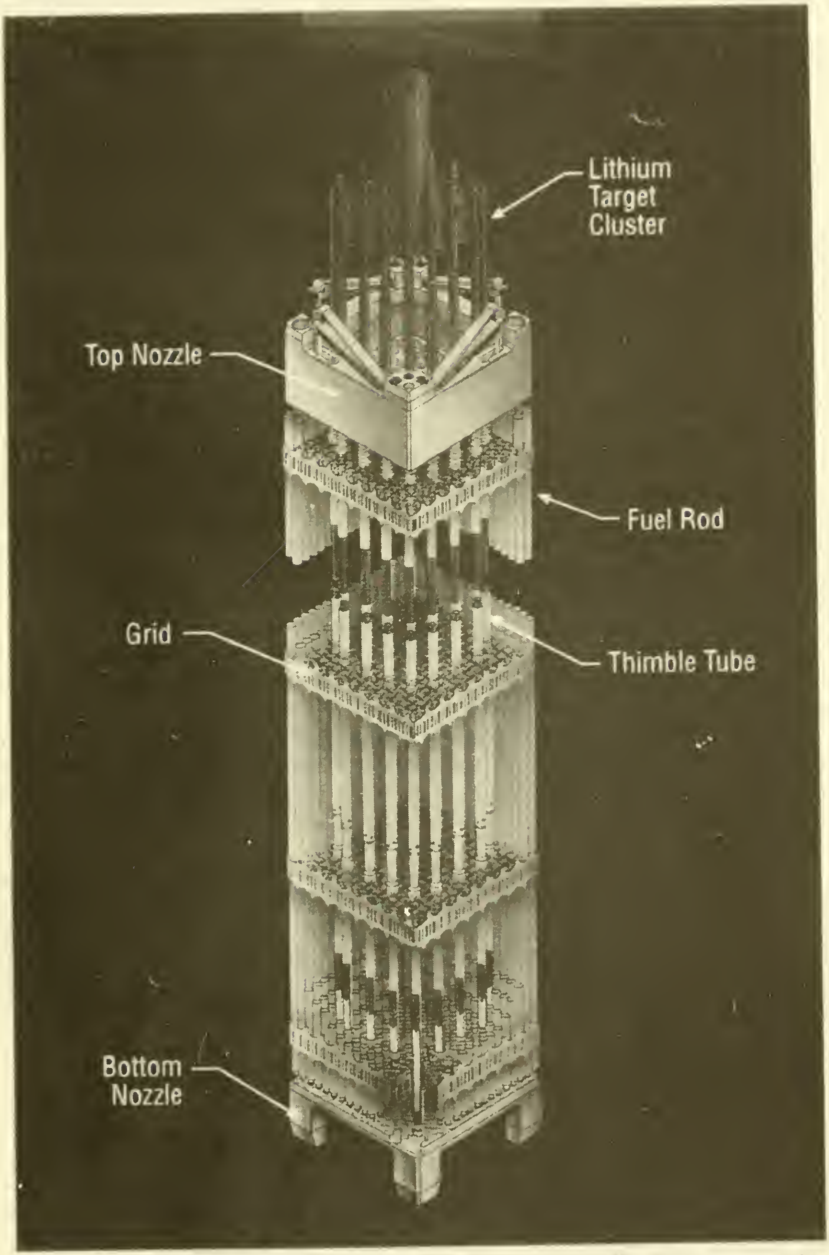
Practice:

- Both products are gaseous and have high diffusion rates in most metals
- Tritium absorbed in zirconium getter
- Stainless steel cladding with aluminum interior coating as tritium barrier
- Large gas plenum volume



A source of neutrons is required to produce tritium.

Exhibit 5



Insertion of Lithium Target Cluster into a 17x17 PWR Fuel Assembly
(Cutaway Illustration)

Mr. SCHAEFER. Thank you, Mr. Miller and gentlemen.

I would turn, first of all, to the gentleman from Georgia, Mr. Norwood.

Mr. NORWOOD. Thank you, Mr. Chairman.

Mr. Miller, since you were last if it is all right I will start with you first.

Mr. MILLER. Yes, sir, Mr. Norwood.

Mr. NORWOOD. I have two very simple questions of you. If you were given the mission today to produce tritium and burn plutonium, when can you be ready?

Mr. MILLER. The technical side of that answer is a little more than that. Technically, it is something we ought to be able to work through.

I heard Mr. Curtis talk about 2003. There are some things you would want to do: work hard with a target designer to make sure you have got a good target assembly to put inside the reactor, do testing to make sure you understand the neutronics effect so you know how the reactor responded. That would be true with the mixed oxide fuel.

There are reactors that burn mixed oxide fuel. As far as we have been able to learn, no one did more than a third of the core. You would have to do those studies, though. We think you can be in a position shortly after the turn of the century—2002, 2003—if such is the requirement of Congress. The hesitation is on the regulatory side. That is more unknown than the technical side of it. That would take refinement as we go through time.

Mr. NORWOOD. Given the testimony we have listened to and read about and talked about, can you do this job for the taxpayers of America for less money than anybody else?

Mr. MILLER. Intuitively we think so. It just seems clear that our situation and with us the Southern System or any existing reactor ought to be able to produce this service to the taxpayer under the various business scenarios less than some of the other capital investments.

Let me quickly add, Mr. Norwood, the Southern System is a strong supporter of nuclear power. We advocate the research into the advanced light water reactor. We look forward 1 day to hope there will be new rounds of reactors built in this country. Nothing that we say should be taken as a knock against new designs, but facing the situation that we all face today, yes, sir, we think we can do it sooner, at lower cost.

Mr. NORWOOD. Dr. Lisowski, would you pronounce that?

Mr. LISOWSKI. Surely, it is li-sow-ski.

Mr. NORWOOD. Thank you very much. I will jump over to you and ask for as brief answers as possible and perhaps longer written answers, if you choose, at a later time.

I believe you said since 1992 DOE has been on the accelerator research end of the line. Did you say 40?

Mr. LISOWSKI. That is correct, less than $40 million.

Mr. NORWOOD. Less than $40 million.

Mr. LISOWSKI. That is correct.

Mr. NORWOOD. Who performed that research and design?

Mr. LISOWSKI. By Los Alamos National Laboratory, Brookhaven and Sandia National Laboratory, in conjunction with a series of industrial partners chosen by competitive process.

Mr. NORWOOD. Where are we in the design of the accelerator?

Mr. LISOWSKI. We are now at what would be technically called the pre-conceptual design stage. We have completed substantial documentation on the accelerator, and we are now ready to proceed to prototyping of a major system of this accelerator.

Mr. NORWOOD. You have to build the prototype to see if what you think will work.

Mr. LISOWSKI. That is not correct. In the accelerator and physics, like a lot of the nuclear physics, processes can scale. We have made tritium at Los Alamos using accelerator systems. We have carefully benchmarked calculational techniques that show us you can make tritium. We can do it in very, very small quantities and, therefore, show that you can scale it to the amount that is required.

Mr. NORWOOD. You would bet the farm on it.

Mr. LISOWSKI. I am betting the farm on it.

Mr. NORWOOD. I think so, too.

How much electricity, Doctor, is required to operate an accelerator? I know you answered it. I want to get it again.

Mr. LISOWSKI. The amount of electricity required depends on the amount of tritium you want to make. It is in proportion. There is a base cost, and you then provide electricity to run the machine at a power level to make however much tritium you have to have.

If you are making two kilograms of tritium, which is a recently provided guidance from the DOE to the tritium project, it takes approximately 400 megawatts of AC power.

Mr. NORWOOD. Do we not have some idea of what we want this prototype to make in terms of tritium? Don't we have a best guess of what we think we are going to be producing?

Mr. LISOWSKI. Indeed. We get that guidance from the Department of Energy.

Mr. NORWOOD. And if we use our best guess, which is all any of us can do, the amount of electricity you are going to need for your accelerator is about equivalent of a nuclear reactor?

Mr. LISOWSKI. We have, during the course of our studies—and, in fact, we looked at all five sites for putting the accelerator. We actually went to utilities and talked with them about how best the electricity was sited. We were surprised that not one single utility suggested they would build a nuclear reactor to power the accelerator.

One of our industrial partners looked at the possibility of providing a dedicated gas turbine service to provide the electricity. That turns out to be the cheapest method of providing electricity to drive this accelerator should you decide to go in that direction.

Let me remind you there is plenty of electric power in the Southeast to supply the needs of this accelerator. I would submit that the electric power utilities would be more than happy to supply that electricity to run the machine.

Mr. NORWOOD. I don't have any doubt. I know some of those folks. They would love to sell you the power.

But my question wasn't so much about the nuclear reactor but the amount of energy—of electricity that would be required to run an accelerator to produce the tritium at our best guess estimate, saying it would be equivalent to a nuclear reactor whether we build one or buy it or whatever. Is that correct as a statement?

Mr. LISOWSKI. It is really not quite a full nuclear reactor, right?

Mr. NORWOOD. Let's jump over the reactor. What do you think it would cost to buy the electricity? I don't care who you buy it from or how you get it.

Mr. LISOWSKI. We have done some studies that show that because the accelerator can avoid operating during the 500 peak hours of production we can actually act as a load leveler for the utilities in the region. That means that you can buy electric power for somewhere in the range of 32 mils per kilowatt hour. In the studies for the Department we actually did a range from 22 mils to 47 mils per kilowatt hour. That means the operating cost, including staff to run it, runs somewhere between $120 and $200 million per year to supply that amount of tritium.

Mr. NORWOOD. Mr. Miller, would you sell him all he needs for $125 million a year?

Mr. MILLER. Well, you want to jump up and say yes, but it depends on when he needs it and what we have available to serve it. But if he wants 400 megawatts of energy for any purpose, tell him to come see us.

Mr. NORWOOD. I think he knows that. But the point I am trying to get here is that we are talking about best guess, intelligent estimates. It is about $125 million a year to buy electricity regardless of where you buy it, is that fair?

Mr. LISOWSKI. I think somewhere in that range is a fair statement.

I think we would not debate with you the question of whether or not it is cheaper to make tritium in an existing commercial reactor. I think what we would debate is whether you can actually do it with the institutional rules that are there and if, when you overcome the barriers to making it, a commercial reactor in fact is a cheaper method of making it for the government.

Mr. NORWOOD. I don't really think scientists will debate this, but I am more concerned about the floor. A lot of people over there will debate it based on some very funny numbers.

If you turn your reactor into one that will produce tritium and also electricity, have you guesstimated about what you would sell the electricity for every year? How much volume dollars would come in from the sale of electricity while producing tritium?

Mr. MILLER. Well, of course the sales price of our kilowatt hours are set by the Public Service Commissions in our retail areas. They would be the one that would make the determination about the rate schedules, applicable schedules.

Mr. NORWOOD. People around here—I hear people say that the sales being produced from that reactor would be about $175 million a year.

Mr. MILLER. Well, there is a calculation you can run if you are given 7 or 8 cents a kilowatt hour and take the generation output capacity factor and things of that nature and come up with a revenue stream, but it would be—it would require some detailed discussions with State regulators before we could guarantee any price to, say, a customer of that size. They would have the legal authority.

Mr. NORWOOD. We got a cash-flow problem maybe of how we get there.

To finish this line up, Mr. Chairman, so far, if my math is right, we are talking about $300 million a year is the difference between what would be produced to sell electricity and what we would pay to buy electricity. And if my math is still correct, over the 40 years we are talking about a $12 billion difference just on the electricity part of this discussion.

I wonder from that—you have already said, we won't debate over which costs more or less. Why in your testimony did you use the word might, might prove to be less costly, meaning the reactor when, clearly, it is less costly? We are talking just dollars. We are not talking about all the other superfluous things. The reactor will be less expensive than an accelerator for the taxpayers, not might. Comment?

Mr. LISOWSKI. Surely I agree with you in terms of dollars, but as a country we have to look at all of the issues, not just the dollars that we pay to make tritium for this country. I think there are institutional issues, matters of long-standing policy, of practice perhaps, not policy but practice, separation of military and commercial electricity. Those are the issues we are talking about.

Mr. NORWOOD. I don't question any of that. I agree we have to look at the whole picture.

Do you mind if we take the word might out of your testimony and say it will prove to be less costly? I would like for you to say that to us as emphatically as you said to us that the ATP is assured to be a practical solution. I know you are scientists, and I know might and may. I understand that. You want to be careful to be sure all the numbers add up.

Is this the Norwood Comedy Hour, Mr. Chairman?

Mr. MARKEY. This line of questioning is.

Mr. NORWOOD. Let's say what we mean. We know the accelerator is more expensive than just the reactor. On that line of questioning, we don't absolutely—in my mind and people I talk to, we don't absolutely know that ATP is assured without any doubt to be a practical solution. That is the point I wish to make, is that we all do, in our testimony, to have a little bias. What we need to get to is what is the best way to produce tritium for the least amount of dollars for this country.

Mr. Chairman, I yield back. Thank you.

Mr. SCHAEFER. The gentleman's time has expired.

As the Members know, the Chair is a little bit liberal on his 5 minutes here today. I want to say that before the gentleman from Massachusetts has his opportunity to inquire.

Mr. MARKEY. Thank you, Mr. Chairman. As nonessential personnel we have nothing else to do today, so—we are not even bit players in this.

Mr. NORWOOD. Will the gentleman yield? You agreed to contribute your salary to charity today anyway with Mr. Graham, didn't you?

Mr. MARKEY. No, I said that it would be—what I said is, we would be better off giving this $100 million to charity in terms of its utility in our society. That would be our big contribution, I think, if we could find a way of doing that.

Anyway, I thank the gentleman very much. I heard—I know the gentleman——

Mr. SCHAEFER. Would you yield briefly?

As the gentleman knows, we were in a footrace to get to the last vote because of the elimination of personnel, so at the next bell I would like to recess and come back. Give us enough time. So go ahead.

Let me check. We may have more than one vote.

Mr. MARKEY. I would say to Mr. Norwood for a second, the gentleman from Georgia, so you understand—I know that you suggested earlier I was the only one on this panel that was antinuclear and——

Mr. NORWOOD. I apologized for that. Mr. Pallone is, too.

Mr. MARKEY. If the debate was over that subject, then I think—and if this was 20 years ago or 15 years ago, it would probably be a relevant line of insult. Okay. However, the truth of the matter is that that is like, in this context, listening to a Frankie Avalon record or Roger Miller record. It is just a golden oldie.

That is not what the debate is about. This is really a debate about what the real needs are of the Defense Department and the Department of Energy and what the best means are of effectuating that end. I personally believe we should debate it in the context of that and Adam Smith's principles of what is the best way of doing it without government subsidies to the private-sector, electrical-generating marketplace of the southeastern part of the United States.

So what I am seeking to accomplish here is not to have this be a debate over pro or antinuclear. We stipulate we need the tritium. There is no debate over that. There is a debate over what period of time we are going to need it and the best means to achieve it. Then, rather than Roger Miller, you know, Trailers for Sale or Rent, we have James Miller 1995 sitting here as our relevant Miller in the 1990's to discuss these issues.

When you introduced this kind of golden-oldie context of pro and antinuclear I think you are mischaracterizing what we are trying to accomplish here, which is to honestly look at marketplace forces and national security needs and to not deal with it in the—so the question for Mr. Miller would be, is he or is his company looking at the new construction of nuclear power plants in that region over the next 5 years apart from whether or not we would have this decision made here, to ask that question relevantly to other panelists in subsequent hearings as well, along with a series of related issues so we can get these facts out.

Because we didn't kill nuclear power. The cold-eyed analysts of Wall Street, making brutal marketplace decisions as to the efficacy of generating electricity—and all it is is a way of boiling water. What is the best way of boiling this water to generate electricity—nuclear, gas, hydropower, cogeneration, or other means? They just made a cold-eyed analysis of it and killed it.

If it is going to be revived it won't be on the basis of our decision here. We are not going to do anything about that. This is a one-shot deal, whether we invest in this. Nuclear itself will live or die in the free market.

So the questions we should be asking are the electrical-generating issues in terms of how this might have market-distorting influences and the national security needs of our country so we most efficaciously produce the tritium over a timeframe and in a way most proliferation resistant in terms of our overall policy.

I just appreciate the regional opportunities given to you to characterize the guy from Boston in this way. I am sure there is a certain home consumption benefit that you can derive from it, but I also want to stipulate that it is also not relevant to this discussion.

Mr. NORWOOD. Would the gentleman yield?

Mr. MARKEY. I will be glad to yield.

Mr. NORWOOD. I want to tell you how deeply sorry I am that I made that comment. But let me tell you why I said that. Because I knew it would bring you back over here, and these hearings have been a lot more fun with you here.

Mr. SCHAEFER. If the gentleman would yield, we are going to recess the subcommittee for approximately 20 minutes, and the gentleman will be up again when we come back.

[Brief recess].

Mr. SCHAEFER. The subcommittee will come back to order.

We will continue with the questioning from the gentleman from Massachusetts, Mr. Markey.

Mr. MARKEY. Thank you, Mr. Chairman, very much.

I am worried about the United States basing its new tritium plant on a government-private partnership. Usually these are good ideas, but I am concerned that there may be risks to national security and to the taxpayer. The utility consortium's interest depends on a commercial uncertainty, whether anyone wants to buy the electricity that a triple-play reactor would produce.

Mr. Davis, on page 3 of your written statement you say that, "It did not take us long to determine that Savannah River Site was the ideal location for our triple-play reactor facility." Quote again. "Our market analysis showed that the Southeastern United States will be the first region of the country to need new baseload electrical generating capacity, right after the turn of the century. Besides the need for power, the region is expected to see high market rates for electricity, thus maximizing the revenue stream." Now that is clearly an important part of your financing plan, that these assumptions are correct and that you can sell the electricity produced by this reactor. If that is not so, then it will have to be subsidized by the taxpayer in order to keep the reactor going since there is a national security concern as well as we have put our eggs in this basket for the production of the tritium.

Now, I have seen projections about the future electricity needs that project a glut of electricity into the foreseeable future. The North American Electricity Reliability Council has projected a continued excess of capacity in electric generation and a general unwillingness of utilities to make new large capital investments. Are they wrong, Mr. Davis? And what evidence do you have that there will be a need for new generation?

Mr. DAVIS. No, they are not wrong, Congressman. Because when you look at the projections they are looking at, what I would call, compared to this project, relatively near-term electricity growth rates between now and 2010, we are talking about a project that will startup in the period of 2005 to 2010 and run to the 2050 time period. So it is a very long-term marketplace we are looking at here for the tritium mission.

If you look in that time period we did hire a consultant out of Atlanta who does market analyses with utilities in the Southeast, throughout the U.S. for that matter but mostly in the Southeast, supporting them in rate cases. He went through and looked at what utilities were filing with public utility commissions for long-term power planning, and that was the basis for our market analysis, and it indeed showed that shortly after the turn of the century, in the 2004 and 2005 timeframe, you start to see the need for baseload capacity to come on-line in the Southeast.

Mr. MARKEY. Did your market analysis factor in wholesale and retail wheeling?

Mr. DAVIS. Yes, it did. We envisioned that to be the way the market will go.

Mr. MARKEY. Can we get a copy of that study?

Mr. DAVIS. Be happy to provide it.

Mr. MARKEY. What has Southern Company projected for the need for additional generating capacity in the Southeast and are you planning to construct any new nuclear reactors in the next 5 years?

Mr. MILLER. Let me take the second question first. No, we are not planning to build a nuclear reactor within the next 5 years. They serve baseload, low-load generation, and that is growing slower than some of the other pieces of the energy market, intermediate and peak. We currently do not see the need for a big baseload plant until well out there in the 2005, 2007, 2009 range. Whether or not that will be served by nuclear remains to be seen, but it is just too early to tell on something like that.

Mr. MARKEY. What impact will retail wheeling, in your opinion, have upon the economically—the economic viability of a triple-play reactor in terms of the region's electricity needs?

Mr. MILLER. I think the driving point behind retail wheeling is to let market forces set the price of electricity, as opposed to, say, a regulating agency; and it is principally because there is a view of excess capacity. Market forces would drive down the cost of a kilowatt hour delivered to it, which makes it incrementally more difficult to recover any large capital investment associated with any other.

Nuclear plants are very capital intensive, and you would have an incremental difficulty that would exist over a coal or combined cycle which—incidentally, a lot of people are selling combined cycle turbines now.

Mr. MARKEY. Exactly.

Mr. Norwood earlier—and I understand where he is coming from—was mentioning 8 cents a kilowatt hour for electricity, which would be projected to be relatively expensive electricity in the retail wheeling—wholesale wheeling area. Five and 10 years from now, if the response to what we are going to try to do in terms of applying marketplace forces does in fact come to be, which is our projection, there will be continued pressure to lower electricity rates. Do you agree with that?

Mr. MILLER. 8 cents per kilowatt would be surprising.

Mr. MARKEY. Surprisingly high.

Mr. MILLER. That would be surprisingly high. You never say never, but that is not what we think.

Mr. MARKEY. And that is not what I think as well. I think that the combination of retail and wholesale wheeling, with improvements in management of electricity generally and further breakthroughs that could be made in terms of the conductivity of electricity, which we hope will be forthcoming as well, are going to have tremendous impacts on price of electricity. That is a lot of what we are assuming out of this committee after the last 10 or 15 years in response to the oil crisis, and we were driven by that, but, ultimately, the benefits are going to be seen in our marketplace.

Would you support, Mr. Miller, our putting in some protections if we chose to go the existing light water reactor route to assure that we are putting into place—that we are not putting into place a new government subsidy for the ratepayer in the Southeast at the expense of the Northeast and Midwest?

Mr. MILLER. Oh, sure, Congressman. We would expect any agreement, whether it is a purchase agreement, whether it is a fee agreement, to be reflective of the United States' taxpayers getting value for what they are paying in the same way that our customers and shareholders and co-owners would see it. I am satisfied that with good faith and intent a fair and reasonable deal could be struck.

Mr. MARKEY. The problem I have right now is we are still stuck with good-faith decisions that we made in the Northeast and Midwest not one generation but two generations ago to help out the Southeast and the TVA and the growing areas of the Southwest and Northwest with regard to the need for electricity and expansion of electrical generating capacity across the whole country. That has now turned into a permanent subsidy that we are having a hard time getting off the books.

Of course, you wind up with this reverse role that those of us from the Northwest and Midwest believe in Adam Smith's principles at this time and others tend to support Adam Smith's role romanticize and extol the virtue of government agencies subsidizing electricity. So you wind up with those of us here in 1977 and 1978 listening to people saying we were going to build 500 new nuclear reactors by the year 2000 or face brownouts and blackouts, including Secretary Schlesinger at this very table.

And some of us in a state of shock as to what the implications of that would be back in 1977 and 1978 and reflecting upon their lack of willingness to build and the real impact that high oil and other prices would have on the conservation ethic and wondering what would be built across the commercial and industrial and residential sectors of our economy are wondering now whether anything we are doing here is going to properly factor in these other changes that we are building in still as a continuation of our response to that oil crisis to ensure we get the full benefit of competition within our own marketplace. We wind up sometimes not fully dealing with that.

So, again, I am not averse to us producing a result that ensures we have a tritium capacity. What I am averse to is us building in faulty assumptions in terms of where the taxpayers or ratepayers will ultimately wind up being with reasonable expectation with data we already have long term. That is my only reservation here, that we are not dealing with this from a factual basis.

Let me just ask Mr. Paine one question, and then I will conclude. How do you assess the relative nonproliferation consequences of building a triple-play reactor using an existing light water commercial reactor and the accelerator? Give us the handy-dandy short guide to how each of these affects the nonproliferation objectives of our country.

Mr. PAINE. I would say that the most critical aspect of tritium production from a proliferation perspective is the extraction, purification and loading capability; and under all these scenarios all of those capabilities remain under government control in defense program facilities. Nobody is suggesting they be commercialized. I think that is the basic fundamental point to make.

There is a—if you want to call it a proliferation concern, I consider it an optical proliferation concern—a question of appearances that using a commercial reactor to provide a backstop tritium capability in the event that the President has to, for some reason, if the negotiation process fails, produce tritium, he has that authority under the Atomic Energy Act. I think as a nuclear weapons state we have that privilege and capability. It is one of the things reserved to nuclear weapons states.

The question of separation of commercial from military applications of nuclear energy simply does not arise in the instance of most countries. Those that are parties to the NPT, they don't have military nuclear programs. So the question of separation of those programs doesn't arise. It only arises in nuclear weapons states and in threshold states.

Now, we are not that concerned about what happens in other nuclear weapons states with respect to this question. They have their own capabilities for producing tritium. So that leaves the threshold states—India, Pakistan and Israel.

Now, Pakistan has no civil program to speak of. So there is no question of separation there.

India has a civil program that is used for military purposes already. So if we are worried about separation of or maintaining this precedent of separating civil from military we have to deal with the question of production of plutonium in civil reactors and its potential military use before we ever get to the issue of tritium.

So if we can reach a global consensus we are not going to produce plutonium, weapons usable proposal in civil facilities, then at some point in the distant future we can worry about the civil-military relationship as applies to tritium.

Mr. MARKEY. Doesn't it also create a more serious proliferation problem because the triple-play would be burning weapons grade plutonium in addition to making tritium?

Mr. PAINE. On the triple-play, yes. The questions there I don't think—you could burn it under safeguards, the plutonium, but that is what is proposed to do in the case of commercial use of plutonium overseas in Japan and France and so forth.

So I don't think, under the current proliferation system, the triple-play poses an impossible burden. The issue really is long term the use of weapon usable plutonium in the fuel cycle for commercial purposes and whether the U.S., by burning plutonium in civil reactors, is creating some precedent that will legitimate use of plutonium as a fuel indefinitely. That is a proliferation concern. I think it is manageable because, after all, what we are doing is disposing of nuclear weapons.

I think if you ask—polled the world and asked them what would you prefer, that the U.S. refrain from burning this plutonium in reactors in order to preserve nonproliferation appearances or to burn it to get rid of nuclear weapons, I think everyone would choose the latter option.

Mr. MARKEY. Mr. Chairman, in 1974, if I could, when the Indians exploded a nuclear weapon in their desert, a coded cable went from the desert to Prime Minister Gandhi that read, the Buddha is smiling, which was code for the successful detonation of a nuclear weapon. The Pakistani Prime Minister then said in response if their people had to eat grass and leaves for a generation that they, too, would gain this nuclear capacity.

That is why in 1980, when President Carter wanted to ship 48 tons of uranium to India, it was a serious question, because the Tarapur reactor was unsafeguarded although the ostensible use of the material was for generation of electricity.

That was the same reason that Menacham Begin ordered destruction of the Osirik reactor in Iraq, because they used the Caramel fuel from France to generate electricity, but the secret program was to construct nuclear weapons.

That later manifested itself in the latter 1980's when we were turning a blind eye to the Iraqi buildup of the nuclear centers. That is the whole April Glaspie issue in terms of whether they were using civilian electricity generation to clandestinely cover a nuclear-bomb-making program.

So we have this ongoing question of whether or not we want to mix our civilian reactor programs with the military, because the rest of the world, that is, the threshold countries, point to us as the example that justifies their program and then ultimately forcing us to expend tens of billions of dollars on the defense side to isolate militarily these countries.

It is a very complex set of issues, but it is one that we clearly have to, on an ongoing basis, deal with. Because while a nuclear power plant is two things at one time, both an electrical generating plant and a bomb factory simultaneously and has both identities, dual identities, and it depends on whose hands it is in, in our hands we see it as a generator of electricity that has this by-product.

Mr. PAINE. That is fundamentally the point. If you go back to the beginning of the nuclear age, it was the position of Oppenheimer and Lillianthal and Acheson and some of our most distinguished statesmen at the time that nuclear energy had this inherent potential and that it would be impossible to allow the civil use of nuclear energy under a so-called inspection or police-type system. The only way you could do it safely would be through universal international ownership.

In fact, what we wound up doing was exactly what Oppenheimer and Acheson and Lillianthal told us not to do, which is to develop an inspection system where we spread the technology around and rely on police-type methods which they believed to be ineffective to ensure they can't be taken advantage of for weapons.

The difficulty is you are building in—particularly when you get into advanced fuel cycle capabilities you build in inherent capability to make weapons at a future date.

Mr. MARKEY. This is an excellent panel, Mr. Chairman. Thank you.

Mr. SCHAEFER. The gentleman's time has expired.

The Chair would recognize the Vice Chairman, the gentleman from Idaho, Mr. Crapo.

Mr. CRAPO. Thank you, Mr. Chairman.

I would like to ask a few questions of Mr. Miller. Could you tell us what equipment changes are required to an existing plant to support tritium production?

Mr. MILLER. Virtually none. It is anticipated you would design the tritium target rod that would perform in physics the same as some of the existing boron rods, put it in a fuel assembly such as we do with our boron rods, and then very, very small changes are anticipated. Of course, you wouldn't want to get into it, but we don't think there would be much.

Mr. CRAPO. So there is a very little difference between existing reactors we are talking about and the triple-play function we are seeking to accomplish.

Mr. MILLER. No, an existing reactor is a triple-play reactor. We have one that can burn mixed oxide fuel, can make tritium and already makes electricity.

Mr. CRAPO. Would the fact you are changing from a boron target to lithium target require a new license or amendment to the NRC operating license?

Mr. MILLER. There are a couple of schools of thought on that. Because of the prominence of the issue it is likely to—the NRC will have more say so. They certainly have the right to order a license amendment if they desire.

Mr. CRAPO. Again switching to a lithium target, what I am saying is, would the tritium production function impact the electricity production function in the reactor?

Mr. MILLER. No, sir. You ought to be able to operate the reactor consistent with public health and safety and produce electricity the same way we do now.

Mr. CRAPO. Is there any functional difference between using an existing reactor versus building a new reactor to accomplish the triple-play function?

Mr. MILLER. Other than money. We do the same thing now.

Mr. CRAPO. How many reactors do we have in the United States now that are capable of burning mixed oxide fuel?

Mr. MILLER. I may have to provide you with a written answer to that.

There are a number of reactors where if you do some design changes you can burn it. Generally speaking, some of the bigger Westinghouse plants had that pre-thought-out, but there are 110 licensed reactors or thereabouts. If you permit me, let me check on that.

Mr. DAVIS. If you want, I can answer that.

Mr. CRAPO. Yes, certainly.

Mr. DAVIS. There are 109 operating nuclear plants in the country; and, theoretically, all of them could burn plutonium. The only question is how much. Depending on the power level and the design of the plant, some can handle a higher quantity of plutonium in the core. So the point is, theoretically, all of them can. The question is, how much throughput each year they could handle.

Mr. CRAPO. You may have answered this between the two of you, but do we have any current reactors that are capable of burning plutonium as a fuel?

Mr. MILLER. Yes sir. The Southern System has theoretically six of them now at three different plant sites. One has been—that mission was considered in its design.

Mr. CRAPO. Are there any advantages in terms of burning plutonium as a fuel with regard to electricity generation?

Mr. MILLER. No, sir. You would still have to balance the heat in the reactor with the steam requirements of your turbine and generator. Depends on what you pay or get paid for the plutonium would be the economic result. But as far as the generators it would see steam and not care.

Mr. CRAPO. Dr. Lisowski, earlier in your response to some questions you indicated that you felt there were institutional barriers to either the construction of a new reactor or the operation of an existing reactor to produce tritium. Could you tell me what those—first of all, are there barriers to either option or both options? And, if so, are the barriers higher or lower in either case? And what are those barriers?

Mr. LISOWSKI. That is a very complicated question for me to answer. I am certainly an expert on accelerators but not on the policy matters, but let me venture my own opinion on that.

Mr. CRAPO. All right.

Mr. LISOWSKI. That is that this country requires a source of tritium, and we don't—we should not mix that mission, making tritium for national defense, with the mission of making electricity, because there are many ways in which intervenors can stop reactors from operating who are jointly making electricity and tritium. That is one institutional barrier we have set up within this country.

That doesn't mean Congress can't change that. It just means that that, from my perspective, is an issue. That is one institutional barrier.

Mr. CRAPO. That would be an institutional barrier to either option?

Mr. LISOWSKI. I think that is correct.

The other issue, of course, is the question about economics. And the issue that is brought up, and I think it is a question that one would have to answer in a policy sense, about the Atomic Energy Act and production of electricity by the DOE, if the DOE owns the facility and produces electricity it can only be sold if it is incidental—if electricity production is incidental to the production of military materials. That is an issue to be debated.

Those kinds of debates as to whether that is allowed or not are institutional issues that could be barriers. The debate over how to do that, the best way to do it could, in fact, be a delay to reactor production of tritium.

Mr. CRAPO. Would any of the other panelists like to comment? Mr. Paine.

Mr. PAINE. I just wanted to have some refinements on the capability of civilian reactors. Mr. Miller can correct me if I am wrong, but there is a distinction here. If you go with a single reactor triple-play to meet the requirement, you are going to have to replace some of the fuel elements. You can't do it just with the replacing the boron 10 radioactivity control rods. It would take, I think, on the order of six to eight reactors if you just want to go the boron rod way.

I think that is the way that least disrupts commercial operation of the reactor. You are going to have to change the fuel loading sequence if you go to a full core—in essence, full core production of tritium.

That seriously interferes I think with the commercial competitiveness of the reactor to go that route, much more disruptive of normal nuclear power operations. So we recommend really intensive investigation of the contingency of production of tritium in the radioactivity control rods as the least disruptive and least-cost method.

Mr. CRAPO. Mr. Miller.

Mr. MILLER. I will speak to that if you wish.

A lot depends on the physics of how these targets do inside your reactor. We have some information on that but not enough. If you want to make a little bit of tritium, then you don't need much extra energy loaded into the reactor to do so. The more tritium you want to make, the more concentrated your lithium targets are, the more energy you have to load in there.

It is not necessarily true that you have to change your fuel cycle. We think we can do it on our existing 18-month cycle. It is not necessarily true that you would have to do an awful lot of changing around of your fuel assemblies, although there may be some. But we think, subject to some additional tests and study, that you could design a lithium target that performs, in a physics sense, much like your existing boron absorbers do and make it all work out.

Mr. CRAPO. Thank you.

Mr. Davis.

Mr. DAVIS. If I could add to that. In our study for the triple-play reactor we did assume that you would derate the power level as much as 100 megawatts to do the full 3/8ths goal for tritium production. At this stage there has not been enough detailed physics work by anybody to know how much impact there is. It looks like it is not that much.

We think 100 megawatts is about as much as it would be on the 1350 megawatt reactor. It may be when we get to the calculations it is even less than that. If the quantities are less, for example, they are talking about a nominal production rate of 3/16ths with capability to do up to 3/8ths, at 3/16ths we may not have to derate the power level. It may be a lot less than a hundred megawatts.

To address the policy question that came up before, I want to point out that what we have talked about is using the design that has already been reviewed and approved for the triple-play reactor by the NRC. We have gone through about 7 years of NRC review, received final design approval for design in July, 1994. We intend to complete the rulemaking procedure by next summer.

The reactor we would use for triple-play is the same reactor. Despite some comments earlier about chopping a reactor, the reactor is the same. The only difference is the core.

It is not complicated. The material the pellets are made from, a mixture of uranium oxide and plutonium oxide, they are doing that in MOX. Otherwise, the fuel looks the same. The targets that produce tritium get loaded in some of the rod locations. Again, no rocket science here. They have been doing it in heavy water reactors before. They have done the demonstration work—or part of it, I should say—for the light water reactors.

When it comes to licensing facilities to actually be built at Savannah River we feel, first of all, being located on the government site will dramatically improve the licensing issues. Because when you look at a 10-mile emergency planning zone around the plant, almost all of it is covered by Savannah River Site.

Second, we are talking about a one-step licensing process, that all the licensing would be done before you start construction. So we avoid a lot of the problems that cropped up during the first generational plants where licensing held up operation of a plant after it was already built. Here you wouldn't turn the first spade of dirt until the licensing was all done up front.

Mr. CRAPO. Thank you.

Mr. SCHAEFER. The Chair thanks the gentleman.

Mr. Lisowski, in your estimation would there be a difference between the wastes that would have been generated by a typical accelerator and those generated by accelerator dedicated to tritium production?

Mr. LISOWSKI. The only differences would be in the amount of waste. There is no fundamental difference between the waste that we generate normally now operating accelerators, but we would operate an accelerator at a higher power level so the waste would be higher. But the waste is orders of magnitude less per year. Even if you talk about low level waste you are talking about a very small quantity for a reactor.

Mr. SCHAEFER. Mr. Paine, would you comment?

Mr. PAINE. No, I don't have much information on that.

Mr. SCHAEFER. Anyone else?

Following up, what are the implications for health and safety of the surrounding communities if the accelerator is utilized? And in the 40 years of accelerator use has there ever been a release of hazardous constituents as a result of accelerator operation?

Mr. LISOWSKI. Whenever you operate any plant that makes ionizing radiation there is clearly radioactive material that is released. So reactors routinely release amounts of radiation, and accelerators routinely release very small amounts of radiation. So, yes, there have been releases.

Are those releases significant for accelerators? The answer is no. I think that the reactor community would argue their releases are negligible.

Mr. SCHAEFER. Mr. Davis, under your particular proposal what is the timeframe for licensing, construction and operation of a new reactor?

Mr. DAVIS. The total time period is about 7½ to 8 years. We are talking 2½ to 3 years for the detailed engineering and licensing activities and then about 5 years for construction. Now the 2½ to 3 years for licensing, keep in mind we already have the reactor design itself pre-approved by the NRC. We are talking about putting the plant on a government site. So we feel like 2½ to 3 years will be adequate for the licensing phase.

The construction phase, 5 years, which includes the site prep and startup of the plant, is consistent with what we are bidding in fixed-price, turnkey proposals overseas now. Although nuclear plants have not been built in the United States in quite some time we are involved in construction projects overseas.

Mr. SCHAEFER. Do you feel a new reactor could be in operation, given our current regulatory structure, by the Department's 2011 deadline?

Mr. DAVIS. Easily. We would expect that, if all goes well, you could have a plant running by 2005.

Mr. SCHAEFER. Mr. Paine, I want to ask you a couple questions. In your estimation is it more cost efficient to utilize MOX fuel to dispose of excess uranium or modify or construct a reactor to burn plutonium fuel?

Mr. PAINE. You mean excess weapons plutonium?

Mr. SCHAEFER. Yes.

Mr. PAINE. I think—all the numbers I have seen, it is clearly more cost-effective to use the existing reactors with a 1/3 core load. Some are licensed for that already. So you don't have to do core designs, build reactors, incur capital cost of construction and the regulatory issues involved. I think it is pretty indisputable that it would be cheaper to use existing reactors than build a new one. That was the finding of the National Academy of Sciences report.

Mr. SCHAEFER. Would plutonium fuel, in your estimation, be a more or less efficient power generator compared to other nuclear fuels?

Mr. PAINE. It is about the same. The enrichment levels are slightly different, but—it is 4.3 percent versus 4.8 percent or something like that; but, basically, it is a one-for-one replacement.

Mr. SCHAEFER. Thank you.

Mr. DAVIS. I would like to add, if I could, as far as efficiency, from a physics standpoint the efficiency is about the same, but we recognize that, economically, there is a penalty to burning excess weapons plutonium fuel. It will cost more to manufacture the fuel assemblies than it would to simply buy low enriched uranium as we currently do in manufacturing the fuel assemblies. There is an added cost because we don't have manufacturing facilities in the country, and they would have to be built.

Mr. PAINE. It is a huge difference, actually.

Mr. DAVIS. It is a small difference we think, but there is a difference.

Mr. SCHAEFER. Any other comment?

Mr. MILLER. Looks like you got the full range of opinion on that one.

Mr. SCHAEFER. I have no further questions.

I think the gentleman from Georgia, Mr. Norwood, has a follow-up question.

Mr. NORWOOD. Thank you, Mr. Chairman. I will wrap it up soon, but at great risk to myself of agreeing with Ed Markey, I have to clear up a few things.

I am concerned, as Mr. Markey is, that we do not make a decision here that later costs the taxpayers a great deal of money, because we have made the wrong decisions in terms of privatization, and I know he is as sensitive as I am to the fact that, in 1965, when his party estimated the cost of Medicare to be $9 billion that, in 1990, it turned out to be $130 billion. That was a serious mistake for the taxpayers, and we don't want to do that here.

We have, in fact, used 8 cents per kilowatt to come up with a figure of $175 million a year that the reactor could produce in selling electricity. Now, I would like for you to state to the committee that if you were to be making tritium you would not have any problem selling the electricity that was the by-product of making the tritium. Is that correct or false?

Mr. MILLER. That is correct.

Mr. NORWOOD. I don't know of any other group in the world more competent to give us the answer to what might be the cost per kilowatt in the 21st century than Southern Company in regards to the Southeast. Mr. Williams, both of you, if you would let us know that and work on that and let us get a feel for what perhaps that kilowatt number might be, it would be helpful.

Mr. MILLER. We will be happy to do that, Mr. Norwood.

Mr. NORWOOD. I heard Mr. Markey talking about he was very concerned, Mr. Davis, that if you build a reactor in Aiken and it starts producing electricity and then we have plant Vogtle down the river producing electricity that perhaps you won't be able to sell your electricity, and he is concerned that the taxpayer comes in and has to bail out what we have called a privatization.

I don't know the right or wrong of that, but would you not guess that even if you could sell none of that electricity there is considerable financial savings to the taxpayer with your reactor over an accelerator, even if you sold no electricity?

Mr. DAVIS. If you look at my chart, the one at the bottom where we talk about $3.5 billion spent on the tritium and plutonium programs over the next 10 years and $400 million a year for operation once it goes into operation for the next 40 years, for that we could put up a System 80-Plus reactor and operate it if it never generated a single kilowatt. The reason our figures look a lot less than that for the annual figure is because we can recover 90 percent of the cost, we believe, through the revenue stream from electricity sales.

Now, as far as the question about can we sell the electricity, in our program plan and alternate we submitted we have identified two different approaches. One is that after the 3-year effort to organize a consortium and work out electric sales agreements, at the end of that 3 years we would have contracts signed with utilities throughout the southeastern U.S. to buy the electricity as baseload capacity so there wouldn't be a question of if you can. You would have contracts in hand, just as they sign contracts with independent power producers now to sell the electricity to them at an agreed-upon price.

The other approach we have identified is a much simpler one, would be to sell the power at market prices when it is generated so, whatever the market price is, it will be sold at that price; and you can always find buyers at that price as long as there is a need for capacity in that time period.

As I have said, we have looked at that. The catch is in a marketplace that has shifted so much to competition and wheeling of power you don't look at just selling it in South Carolina and Georgia. We found in our market analysis, for example, that in the early years a lot of electricity would be wheeled down to Florida, for example.

So there is always someplace you can sell the electricity. The only question is the price. And even at that we proposed in the original plan to literally lock that in in contract agreements like an IPP would do with utilities so you know what you will be able to sell it for and what the price is. That way the government knows the risk before it ever signs the contract. Otherwise, it just doesn't sign.

Mr. NORWOOD. The bottom line is whether you sell electricity or not the taxpayer fares better using a reactor than an accelerator?

Mr. DAVIS. You can't lose. Like I said, from the figures you see over there, there is no way it costs more than the other options, even if it never generates any electricity.

Mr. NORWOOD. Mr. Paine, I enjoyed your comments, and I am sorry I haven't gotten around to you, but I want to ask you one quick question. You made a statement I just totally agree with, and I wish you would explain it because I am going to cut it out of the record and send it to Ed. People in this country would prefer for us to burn plutonium rather than having it sitting around in storage all around the country. Am I paraphrasing you correctly?

Mr. PAINE. Yes. I said if it was a choice between, I think, burning the weapons plutonium in reactors to get rid of it, rather than leaving it in pits at Pantex indefinitely for the purpose of preserving nonproliferation appearances, that we keep a separation between our civil and military sectors, I think the people of the world would choose on proliferation grounds for us to destroy our weapons.

So I don't have some of the sensitivity that a lot of people do to the question of using weapons plutonium in reactors for the purpose of destroying weapons. That is acceptable if it is limited to that. My problem with using plutonium in the civil sector is it would lead to an industry that results in wholesale, massive separation of plutonium for the generation of electricity which, if duplicated around the world, would create a fantastic proliferation problem.

So we have to be clear what we are talking about. We are talking about disposing of weapons and using existing reactors in a nuclear weapons state, the United States, Russia or both, to do that. We are not talking about starting a new plutonium industry worldwide.

Mr. NORWOOD. I live on the Savannah River, 10 miles from the Savannah River Site, and I can assure you I don't like the plutonium sitting there. If we have the opportunity to burn it and get it off the face of this earth that is what I want to do. I think most Americans would agree.

Mr. PAINE. You don't actually in this irradiation scheme get rid of it, actually. You still have the spent fuel elements. You get rid of some plutonium and contaminate it with a higher isotope that is useless for weapons, but you don't——

Mr. NORWOOD. You have a net reduction in the long run.

Mr. PAINE. You put the plutonium into a form that it can't easily be put back into the weapon. It has to go back to Yucca Mountain.

Mr. NORWOOD. I don't care what we do. Maybe we should vitrify it and shuck it off Yucca Mountain, but we want to get the liquid out of there.

Mr. Chairman, I have done all I can do.

Mr. SCHAEFER. The Chair thanks the gentleman for his eloquent round of questioning and would say to all the panel we very much appreciated your being here. It has been a very informative session.

I would say to you that members of the committee may be sending questions for written responses from you on anything that we can come up with. I think our staff has quite a few more they would like to ask.

We appreciate your being here today. The subcommittee is now adjourned.

[Whereupon, at 2:12 p.m., the subcommittee was adjourned.]

[Additional material submitted for the record follows.]

PREPARED STATEMENT OF LINDEN BLUE, VICE CHAIRMAN, GENERAL ATOMICS

Mr. Chairman and Members of the Subcommittee, on behalf of General Atomics I want to commend you for conducting this hearing on what we believe to be one of this country's most pressing national defense issues: how best to produce tritium for the nation's nuclear weapons stockpile.

Further, we commend the Speaker's Task Force on Nuclear Cleanup and Tritium Production for its excellent evaluation of our nation's tritium supply situation. The recommendations contained in its report entitled "Getting on With Tritium Production" are highly appropriate and Congress should not fail to implement them. In particular, producing the needed supply of tritium by means of a new reactor which can offer safety, environmental and economic advantages must not now be abandoned.

In addition, by fueling a new tritium production reactor with surplus weapons plutonium, the dual missions of tritium production and plutonium disposition can be simultaneously accomplished while generating revenue producing electricity to offset costs. Our evaluations indicate that building a new multipurpose reactor on a government owned site is highly cost effective and low risk even if the requirement for tritium supply was further reduced or eliminated.

In brief Mr. Chairman, General Atomics makes the following additional recommendations for the Subcommittee's consideration:

- Further studies on the issue of private versus Government ownership should be included in any further evaluations of the multipurpose reactor option. Government ownership of a multipurpose reactor facility is the least cost option. We strongly Private ownership of a multipurpose reactor would result in reduced up-front capital outlays but in higher life-cycle cost to the Government relative to Government ownership.
- The Gas Turbine-Modular Helium Reactor (GT-MHR) should be included in further evaluations of the multipurpose reactor option for the following reasons:
    1. The Government expended in excess of $430 million over the five year period 1989 to 1993 to develop the MHR technology for tritium production. This investment and the considerable technological progress which resulted must not be ignored.
    2. The "spent fuel standard" for plutonium disposition is not adequate for the long term. The NAS defined the spent fuel standard but recognized that "Over the long term, however, steps beyond the spent fuel standard will be necessary

for both weapons plutonium and the larger civilian stock." High plutonium destruction can be achieved in MHR systems to effectively satisfy the long term beyond spent fuel objective.

3. Contrary to the expectations of the National Academy of Science (NAS), advanced reactors (such as the GT-MHR) would not require significantly longer time for implementation, would not be more costly, but could provide much more effective disposition of surplus weapons plutonium relative to alternatives.

4. As a side benefit, after first deployment as a multipurpose reactor, the GT-MHR would provide a nuclear power system ideally suited for meeting the burgeoning demand for electricity generation in developing counties. The GT-MHR generates electricity at a net thermal efficiency of about 48%, about 50% higher than light water reactors, and has been evaluated to have the highest safety, the lowest cost, the least environmental impact, and the most proliferation resistance of any fission reactor system.

- The potential for a cooperative program with Russia should be included in further evaluations of the multipurpose reactor option. Russia has indicated that they are going to use their surplus plutonium in reactors and they are interested in a cooperative program to develop the GT-MHR for disposition of surplus weapons plutonium. Such a program would substantially reduce costs and help bring about uniform plutonium disposition policies and practices.

Mr. Chairman, although the Speaker's Task Force has done yeoman's work on a very difficult issue, there are a number of issues associated with the multipurpose reactor option that are not fully addressed in the Task Force's report which should be taken into account in any Congressional and/or agency action. These fall into the following general categories and will be discussed in more detail below: safety and licensibility of existing commercial reactors for tritium production, private versus government ownership, work already accomplished on new tritium production reactors, plutonium disposition proliferation resistance, benefits of applying new technology, and the need for a plutonium disposition approach acceptable to Russia.

Safety and Licensibility of Existing Commercial Reactors for Tritium Production

The Speaker's Task Force recognizes the use of commercial reactors for weapons tritium production would tend to blur the line between commercial and military uses of nuclear energy. Such use could alter the perception of the rest of the world community of US nonproliferation efforts and policies. Another consideration with regard to the use of existing commercial reactors, is their safety and licensibility for the production of tritium.

Commercial light water reactors (LWRs) have been identified as backups for the supply of tritium in the event of a national emergency and some target development work has been performed. However, serious safety concerns about excess reactivity effects during accidents have not been resolved. These concerns arise from the relatively low temperature limit for the targets which could be rapidly exceeded under accident conditions resulting in loss of lithium target material and causing a major increase in reactivity. This is a safety issue for which existing reactors have not been licensed. Extensive NRC review, with concomitant demonstration test programs, and public concern is likely. This concern also applies to building a new LWR of commercial design on a government site. Reactor alternatives to LWRs for which tritium targets have already been developed should receive consideration for the multipurpose reactor application.

Private versus Government Ownership

Industry consortia have proposed to construct and operate a privately owned multipurpose reactor facility on a Government site with the sale of electricity to surrounding utilities. The private owner would be responsible for all design, licensing, construction and operating costs directly associated with the nuclear reactor system(s), the power conversion plant(s), and the fuel fabrication facility. The private owner would receive all revenues resulting from the sale of electric power generated by the facility over its lifetime. The *claimed* advantage is that a privately owned and financed approach would provide the lowest cost solution to the Government.

Although relieved of many of the up-front capital costs, the Government would still be liable for certain costs including: development and demonstration of the tritium target technology, construction and operation of the tritium target fabrication and recovery facility, support of a multi-year study to allow the private entity to organize and develop sufficient financial and engineering data to establish project cost and risk, and annual operating costs in excess of electric sales revenues.

In addition, the Government would have to provide guarantees and commitments to the private owner to facilitate financing of the project. These guarantees and commitments would have to be scored.

Our analyses of the private ownership option show that *the present value of the life-cycle costs to the Government will be approximately $3 billion more than for Government ownership.* Although the up-front cost to the Government will be reduced, the Government will have to make large annual payments to the private owner to cover annual operating costs. Levelized over 40 years, the annual payments are projected to be on the order of $200 million, dependent on assumed financial parameters. The higher cost of the private ownership option is the result of a higher average cost of money for a privately financed project and the need to provide for the return on and of the investment.

In summary, private ownership of a multipurpose reactor would result in reduced up-front capital outlays but in higher overall costs to the Government relative to Government ownership. While reduced up-front costs are attractive over the short term, the lower net life-cycle costs associated with Government ownership are an important consideration.

Work Already Accomplished on New Tritium Production Reactors

In the 1980s, the Department of Energy (DOE) undertook a thorough examination of available reactor technologies to determine the best approach for providing new tritium production capacity. The DOE strategy, issued to Congress in 1988, involved a dual reactor strategy: a heavy water reactor (HWR) employing the technology used by the US in the past for tritium production, and a modular helium reactor (MHR) employing advanced safety concepts and having the capability of electricity generation to produce revenue for off-setting costs. At that time, the MHR was identified as the Modular High Temperature Gas-cooled Reactor (MHTGR) and employed a steam cycle for electricity generation.

The New Production Reactor (NPR) program was initiated in 1989. The HWR and MHR conceptual designs were completed in 1990 and preliminary design work (Title I) was begun along with needed development testing activities. In late 1991, DOE decided to delay the NPR program based on the agreements between President Bush and President Yeltsin to reduce the number of nuclear weapons. Subsequently, in October of 1992, DOE announced deferral of the NPR program based on the lack of immediate need. Design and development work on the MHR continued through 1993 to complete work in progress in a well documented and orderly manner. One accomplishment was the qualification of full scale tritium production targets for the MHR and demonstration of tritium recovery from full size irradiated MHR targets by two different processes.

Over $430 million was expended in the development of the MHR technology for tritium production and a like amount was spend on the HWR technology. The technology is still available and the investment should not be wasted.

Plutonium Disposition Proliferation Resistance

Although we recognize this hearing focuses on tritium production, the potential for huge savings to the taxpayer's via a multipurpose (triple play) reactor necessitates some discussion on the disposition of surplus weapons plutonium.

The National Academy of Science (NAS) defined, and the DOE has adopted, the "spent fuel standard" and existing LWR fuel cycles and vitrification (with high level wastes) were identified as the most expeditious alternatives for removing the "clear and present danger". The Academy went on to state *"Over the long term, however, steps beyond the spent fuel standard will be necessary for both weapons plutonium and the larger civilian stock."* The NAS recognized the spent fuel standard is not adequate to minimize the prospect the material could be reintroduced into the arsenal from which it came.

Reactor grade plutonium extracted from LWR spent fuel is suitable for weapons purposes and the technology for performing the extraction is readily available. Even though it is of lower quality than weapons grade plutonium, the U.S. has successfully tested a nuclear weapon using plutonium equivalent to reactor grade plutonium. Consequently, the spent fuel standard does not provide an effective barrier to reuse.

The MHR provides the capability to consume more than 90% of the initially charged plutonium-239 (the weapons desirable isotope) and more than 65% of the total initially charged plutonium in a once-through cycle. Equivalent figures for a LWR once-through cycle are about 50% plutonium-239 consumption and about 25% total plutonium consumption. The more deeply burned MHR spent fuel has superior resistance to diversion and proliferation making reintroduction of plutonium into weapons from MHR spent fuel considerably less likely than from LWR spent fuel.

The NAS did not recommend the use of advanced reactors (including the MHR) because of the expectation that they would be more costly, would take more time, and accomplish little more than the use of existing reactor systems. The MHR will require three to five years longer time to deploy (for completion of design and development), but this extra time is inconsequential in the context of the 30 to 40 year time frame required by any other newly constructed reactor alternative. Net life-cycle cost analyses of MHR systems for the disposition of weapons plutonium, including the up-front design and development costs, show them to be either less costly, or on par with other new reactor systems, depending on risk contingency assumptions. And, as noted above, MHR spent fuel provides superior proliferation resistance.

In summary, relative to any other reactor system deployed for plutonium disposition, the use of the MHR advanced reactor system will provide much more effective disposition of the plutonium, will not require significantly longer overall time, and will not be more costly.

Benefits of Applying New Technology

A multipurpose reactor can simultaneously accomplish the missions of tritium production and plutonium disposition while generating electricity to produce revenue to offset costs. An even broader mission can be accomplished if the MHR is deployed as a multipurpose reactor; the US can re-gain world leadership in nuclear energy by providing the world with a safe, economical nuclear energy alternative for use in lieu of burning fossil fuels and contaminating the atmosphere.

Technology developments made during the past decade have made possible a direct Brayton (gas turbine) power conversion cycle coupled with a modular gas reactor. Using these technology developments, the system identified as the Gas Turbine-Modular Helium Reactor (GT-MHR) has been developed. The GT-MHR generates electricity with a net thermal efficiency of about 48%, about 50% higher than LWRs. The GT-MHR has been evaluated to have: the highest safety margins of any current or proposed fission nuclear power concept (its melt down proof); a highly competitive cost of electricity generation in the projected time frame of deployment (less than any other form of new generation); the least environmental impact of any nuclear fission alternative (50% less thermal discharge; 75% less heavy metal waste); and the most proliferation resistant fuel cycle of any nuclear fission system (no reprocessing capability exists for MHR spent fuel anywhere in the world).

The GT-MHR resolves the safety and economic concerns associated with current nuclear power. First deployment of the GT-MHR as a multipurpose reactor to accomplish the tritium production and plutonium disposition missions would result in development of a safe, economic nuclear alternative to help satisfy the burgeoning demand for electricity in the developing countries and help avoid environmental impacts of the acid rain and greenhouse gas effluent spewed into the atmosphere should the demand be met by the most likely alternative—coal plants.

Need for a Plutonium Disposition Approach Acceptable to Russia

Contrary to the view in the US of weapons plutonium being a waste material, the Russians regard their plutonium to be a national treasure. They have stated their intent to extract energy from their plutonium by using it as fuel in nuclear reactors. They prefer to utilize the GT-MHR system since it is the most effective and environmentally attractive reactor option. Also, such a project creates a commercial product while providing employment for their weapons engineers and scientists. Some outside financial assistance would be required to help pay for the design and development costs but they are willing to cost share and pay back financial help received for construction of the lead module from the eventual sale of electricity generated.

A joint US-Russia program to develop and deploy the GT-MHR to disposition weapons plutonium would be a win-win situation for all concerned. Russia's surplus weapons plutonium would be securely dispositioned, weapons engineers and scientists would be put to productive work, the design and development costs would be very low if performed in Russia, and both the US and Russia would realize a system design with strong commercial potential.

The DOE position on the Russian proposal for use of GT-MHRs to disposition plutonium is that use of plutonium in reactors is against their policy because it would encourage a plutonium economy. This position is incomprehensible when Russia's intent, in lieu of using GT-MHRs, is to use the surplus weapons plutonium in fast breeder reactors. Russia says they are going to use their surplus plutonium in reactors and prefer to use GT-MHRs which render it undesirable for reintroduction into the arsenal from which it came.

CONCLUSIONS

The Speaker's Task Force on tritium production report leaves little doubt that DOE has not established an effective program for assuring the Nation an adequate supply of tritium and the lack of such a program is putting the Nation's future security at risk. In addition, DOE appears unwilling to consider the potentially more cost effective approach of combining the tritium production and plutonium disposition missions.

We urge Congress to direct DOE to: Perform a comprehensive study of the multipurpose reactors, including a Gas Turbine-Modular Helium Reactor, for providing the capability to produce tritium while destroying weapons plutonium and generating electricity to offset costs; and Submit the report of the multipurpose reactor study to congress prior to any Record of Decision for tritium supply or plutonium disposition.

PREPARED STATEMENT OF WILLIAM S. LEE, CHAIRMAN EMERITUS, DUKE POWER COMPANY

Let me thank Chairman Schaefer and members of the Subcommittee for this opportunity to share my views. The focus of this hearing is tritium production, but as introduction, let me first address the closely-related issues of nuclear power to meet future electricity demand and plutonium disposition.

I am William S. Lee, Chairman Emeritus of Duke Power Company. I am a professional engineer and have been engaged in the production of electricity from the atom since in 1957. These views are my own and not intended to represent the position of any entity with which I am affiliated.

Need for Additional Baseload Electric Generation

Due to a combination of lower economic growth, conservation and increasing efficiency in energy usage, the yearly growth in US electricity demand slowed from 7 percent in the early 1970's to 2 percent today, and 1.5 percent is expected to continue well into the early part of the 21st century. The baseload generation that was already committed when this slowdown became apparent has been adequate for that category of supply in the generation mix until about the turn of the century. Only peaking capacity has been installed in recent years, and the mix between peaking and baseload will be in its proper balance soon after the year 2000. By the year 2010, the US will need some 80 thousand mw of additional baseload generating capacity to come on stream. And in the following decade, about 93 thousand mw more will be needed. Three types of power plants using three different fuels are eligible to meet these needed additions to baseload capacity: combined cycle natural gas-fired units; coal-fired steam or coal-gasification-combined-cycle power plants; and nuclear-electric generating plants. Each type has different characteristics of initial capital cost, long term competitiveness, environmental, impact and exposure to inflation of fuel cost. Since each type involves a set of assumptions about the future, it seems prudent to reduce the risks associated with those assumptions by building a diversity of types and fuels in our mix of needed baseload generation.

Nuclear plants have demonstrated that they can be competitive and reliable. Nuclear power has the distinct environmental advantage of supporting global clean-air objectives when compared to burning fossil fuels for electricity. With standardized designs and one-stop licensing called for by the Energy Policy Act of 1992, construction schedules and costs can be predictable. New nuclear plants are under construction in a number of other countries that recognize the importance of the atom in their own energy diversity. Nuclear power is very important to economies without fossil fuels such as Japan, Korea and Taiwan, and new nuclear plants are under construction or being considered in Russia, the Ukraine, the UK, Indonesia and Mainland China—all of which have fossil fuels. Nuclear-generated electricity is highly eligible to meet a portion of the growing needs for baseload capacity in the United States.

Nonproliferation of Weapons-Grade Materials

Continuing widespread deployment of nuclear power plants around the globe requires continuous strengthening of nonproliferation systems of the International Atomic Energy Agency (IAEA). This applies to both uranium and plutonium materials associated with the power-plant fuel cycle. A more urgent proliferation issue is the excess weapons plutonium materials in at least three countries—Ukraine, Russia and the US. Highly enriched uranium for weapons can be readily diluted and burned as fuel in conventional power reactors. The National Academy of Sciences recommends one of either of two methods to dilute the weapons plutonium concentration to be similar to that found in the spent fuel from commercial reactors—this is called the spent fuel standard. One method uses the plutonium as fuel in an energy producing reactor and the other would mix the plutonium with other waste and vitrify it into glass logs for storage in an underground repository. In my view, the best of these two is to burn the plutonium in reactors and make useful energy—the resulting spent fuel can be managed like conventional spent fuel as envisioned by The Nuclear Waste Policy Act of 1995 (HR 1020). In my view, burning the weapons plutonium, which is perfectly suitable for use as a fuel in ordinary reactors, is consistent with our conservation of resources and recycling.

Two Types of Reactors are Ideally Suited for Burning Plutonium

Because of particular physics characteristics, most reactors cannot utilize exclusively plutonium-enriched fuel. Although they can burn some plutonium when commingled with conventional uranium fuel, burning the excess stockpile would require involvement of many more reactors than if burned in reactors that can accept exclusively plutonium-enriched fuel.

One of these reactors is the System 80+ offered by ABB Combustion Engineering. It is a light water reactor that has received design approval from the NRC under the new standardized plant approach. It is ready for deployment and is being built in Korea; having been adopted as that country's standardized plant. This reactor can use fuel exclusively enriched with plutonium or it can use a mixture of plutonium and uranium. But a reactor dedicated to plutonium burning would consume the stockpile faster. The economics of generating electricity while destroying weapons plutonium goes a long way toward paying for the plant without having to finance special facilities to mix and vitrify weapons materials as waste without using the valuable energy content. I am familiar with the System 80+ design and believe it will be a major player in the array of standardized designs available in the US market for meeting baseload. With its preapproved standardized design, a System 80+ reactor can be brought into plutonium-burning service in the shortest possible time.

Also ideally suited for burning plutonium is the modular helium-cooled reactor proposed by General Atomics and similar to experimental gas-cooled reactors built in this country, Germany and Russia. This advance model uses a direct cycle gas turbine as the prime mover of the electric generator, thus avoiding the steam cycle altogether. This has substantial efficiency advantages, being half again as efficient as the steam cycle. This type of advanced reactor has another feature that, in my mind, will assume even greater future importance. It is meltdown-proof. It is physically impossible upon loss of coolant accident for its core temperature to reach the melting point of its ceramic fuel. As you know, metals generally melt at lower temperatures than do ceramic materials. This feature makes the modular gas-cooled reactor particularly attractive for widespread deployment around the world including undeveloped nations where the sophistication of technology and training may vary. The gas-cooled reactor, like the System 80+, can be fueled exclusively with a plutonium-enriched core. The gas-cooled machine has the further capability of burning the plutonium content down to one-fifth of the normally expected plutonium concentration in the spent fuel standard. This captures 90 percent of the contained plutonium energy instead of only 50 percent, another example of conservation and recycling. Also, the further burndown gives it an incremental nonproliferation advantage. The modular gas-cooled reactor has not yet been demonstrated which must be done before the reactor is eligible for commercial deployment later on in the next century. Its design and licensing are not mature like the System 80+, which will add to the time of completion of the gas-cooled option. Its plutonium burning capability and the long-range attractiveness of this technology makes it especially appealing for converting swords into plowshares. Because its commercial realization is long-term, only government support can fund the needed demonstration. Unfortunately, a coalition of those with anti-nuclear tendencies along with vigorous budget-cutters canceled government support of the gas-cooled reactor development. This should be corrected and its use as a plutonium burner might be exactly the appropriate vehicle to demonstrate this reactor type.

Tritium Production

Tritium production can be most readily accomplished by replacing one or more fuel assemblies in a power reactor with special assemblies containing tritium-producing targets. With the normal refueling schedules, these special assemblies can be shipped periodically to a government facility for separation of the tritium. This is so straightforward that it is a surprise to me that DOE would spend two or more years and many millions of dollars studying other alternatives. Studies by an independent DOE consultant show the acceleration alternative to have life-cycle costs four to six times the reactor option, yet DOE is proceeding to allot "80-90 percent of its $323 million tritium funding to exploring the acceleration option."[1] To build an energy guzzling accelerator to either produce tritium or burn plutonium seems wasteful and unnecessary.

Although it is technically feasible to insert tritium targets in existing power reactors, the owning utilities are reluctant to do so. These reactors were committed on the basis of electricity production. Making weapons material would be a major change in purpose. In the utilities, we have endeavored to separate ourselves from the weapons program; to make it clear to the public that a power reactor is not a bomb and cannot detonate; and not to invoke the opposition of anti-weapons folks to our civilian program. If push comes to shove, however, and such a critical national need for tritium arose that the Congress enacted laws mandating the use of one or more existing power reactors, we are all patriots.

Combining Plutonium Burning and Tritium Production

One or more new reactors could be built to burn plutonium as its routine purpose and produce tritium only when needed. Its purposes would be clearly set forth in advance. It could destroy plutonium day in and day out, year after year and make substantial reductions in the worldwide stockpiles of weapons materials while producing large amounts of electricity. It would only have to produce tritium when called upon, and its design would be suitable for insertion of tritium targets. That second purpose could be understood in advance at the time the project were approved. This makes sense without having to force a major policy shift on the owners of existing reactors.

Multi-purpose Reactors

Both the System 80+ and the modular gas-cooled reactor are well suited for both plutonium burning and tritium production. It makes sense to combine these two purposes into one project—a multi-purpose reactor. The electricity it produces can go a long way towards paying the cost of the project. It would be an energy producer instead of an energy guzzler.

Its only drawback is that it would be inconsistent with the seeming policy of the current Administration not to propose new reactors in the United States and to oppose the development of more advanced types of reactors. Apparently, only North Korea is eligible for support from the current Administration for new reactors—not the US.

Siting of Multi-purpose Reactor

The Savannah River complex is the ideal site for a multi-purpose reactor. Environmentally, it is already qualified. The technological infrastructure presently exists for both tritium and for plutonium processing. The plutonium fuel fabrication plant could be located on the complex, an ideal location for international surveillance as a part of the nonproliferation system. There should be only a few plutonium fuel fabrication plants in the entire world, and those carefully controlled. The surrounding utilities in the southeast will have a definite need for baseload electricity generation early in the next century.

Financing

A site on the Savannah River complex could be leased to the consortium power producers that would build the plant and market the electricity. Government financing would be deminimus. There would be several tens of millions of dollars of upfront money to be appropriated by the Congress to put the concept together. Then I would expect government guarantees for bonds would be required in order to finance the project in the marketplace considering the investor's view of the financial risks associated with a government related project. These bonds could be retired on a staggered basis and replaced with conventionally funded debt and equity once the electricity-producing project had proved itself in the marketplace. Meantime, to fund its design, construction and start-up, government-backed bonds sold in the private market should be feasible without affecting the deficit.

Conclusion

Our national objectives of producing tritium if needed and of reducing the world's stockpile of weapons grade plutonium can be best served by an electricity-producing multi-purpose nuclear reactor. The ideal location would be the Savannah River complex of DOE. The next step will be for the Congress to authorize and appropriate the moneys necessary to bring these studies to a mature stage for decision by the Congress to move ahead.

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[1] Nuclear Energy Institute's "Infowire" of October 10, 1995.

Thank you for the opportunity to submit these views. I will be delighted to respond to any questions or inquiries.

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